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American Machinist

A Practical Journal of Machine Construction

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Contents 847. Advertising Index 69

Pond Reversing Motor Planer

with reversing motor connected direct to pinion driving shaft

13 Cutting Speeds 13 Return Speeds

No clutches, belts or sliding gears

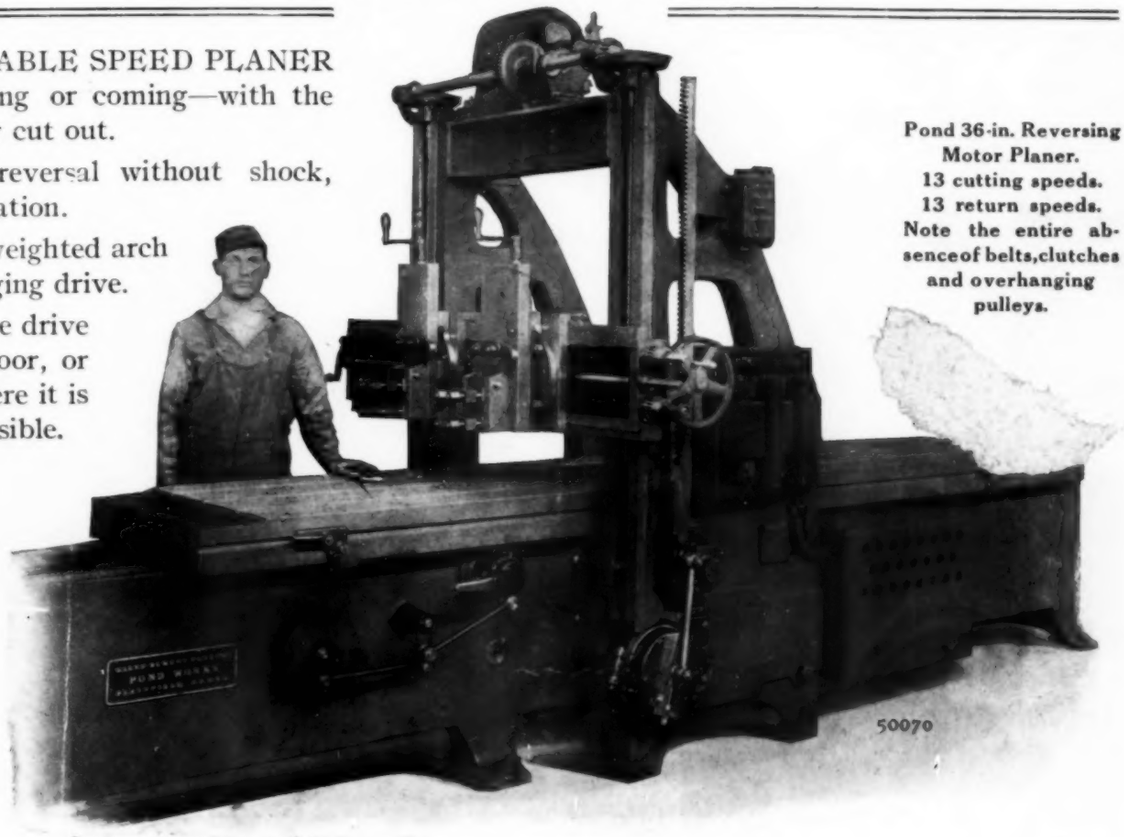
No mechanical reversal

A VARIABLE SPEED PLANER —going or coming—with the uncertainty cut out.

Instant reversal without shock, jar or hesitation.

No overweighted arch or overhanging drive.

The entire drive is on the floor, or near it, where it is easily accessible.



Pond 36-in. Reversing Motor Planer. 13 cutting speeds. 13 return speeds. Note the entire absence of belts, clutches and overhanging pulleys.

Write for illustrated pamphlet.

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(See offices on page 3)

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(See pages 65 and 66)

Boring Clapper Boxes in the Lathe

Western Correspondence

A method of mounting planer clapper boxes and tool blocks on a face-plate fixture for boring the taper pin hole square with the bearing surfaces of both box and block.

The tool outfit and the series of operations, including center spotting, drilling and boring, assure accurate results with a minimum of time loss in setting the work and changing the tools.

The Cincinnati Planer Company, Cincinnati, Ohio, has recently devised and put into service some unusually efficient tools for boring the taper-pin holes in the clapper boxes and tool blocks of its planers. These tools are used in a 30-inch engine lathe, and the operations consist in mounting the clapper box with its tool block on a face-plate fixture; spotting the center for the taper-pin hole with a stiff drill secured in a holder on the compound rest; running a twist drill clear through the two castings while the drill is driven rapidly by an independent attachment; step drilling the hole to produce a series of diameters approximating the required taper; boring the hole to size and exact taper by a single-point tool controlled by the taper attachment of the lathe.

When the work leaves the machine, a taper reamer is slipped into the hole and given a turn or two by hand merely for the sake of scraping off what is commonly known as the "loose metal," without actually affecting the real surface of the material around the hole or the accuracy of the taper due to the method of boring with the single tool and taper bar.

The Fixture and the Work

The special tools are illustrated by the accompanying engravings, and Fig. 1 shows the face-plate fixture clearly, with the work in position for centering, drilling and boring. From this view and from the others revealing the sequence of operations, it will be seen that the fixture consists of a heavy casting in the form of a knee, with a circular base doweled to the face plate, and with a horizontally projecting ledge provided with a box-like seat for the work. When the clapper box and its tool block are slipped into the fixture, a locating stud which enters the hole drilled in the clapper box for the swivel stud, positions the work and three thumb screws and a tap bolt secure it in place.

The general proportions of the fixture are shown in the drawing, Fig. 2, and details of the clapper box and tool block of the size illustrated in Fig. 1 are given in Fig. 3. It may be stated here that there are five fixtures of this type to handle the different sizes of clapper blocks for the complete line of planers, and in most cases the fixtures will each take care of several sizes of boxes; however, in the case selected for illustration, only one size of clapper box is bored in the fixture.

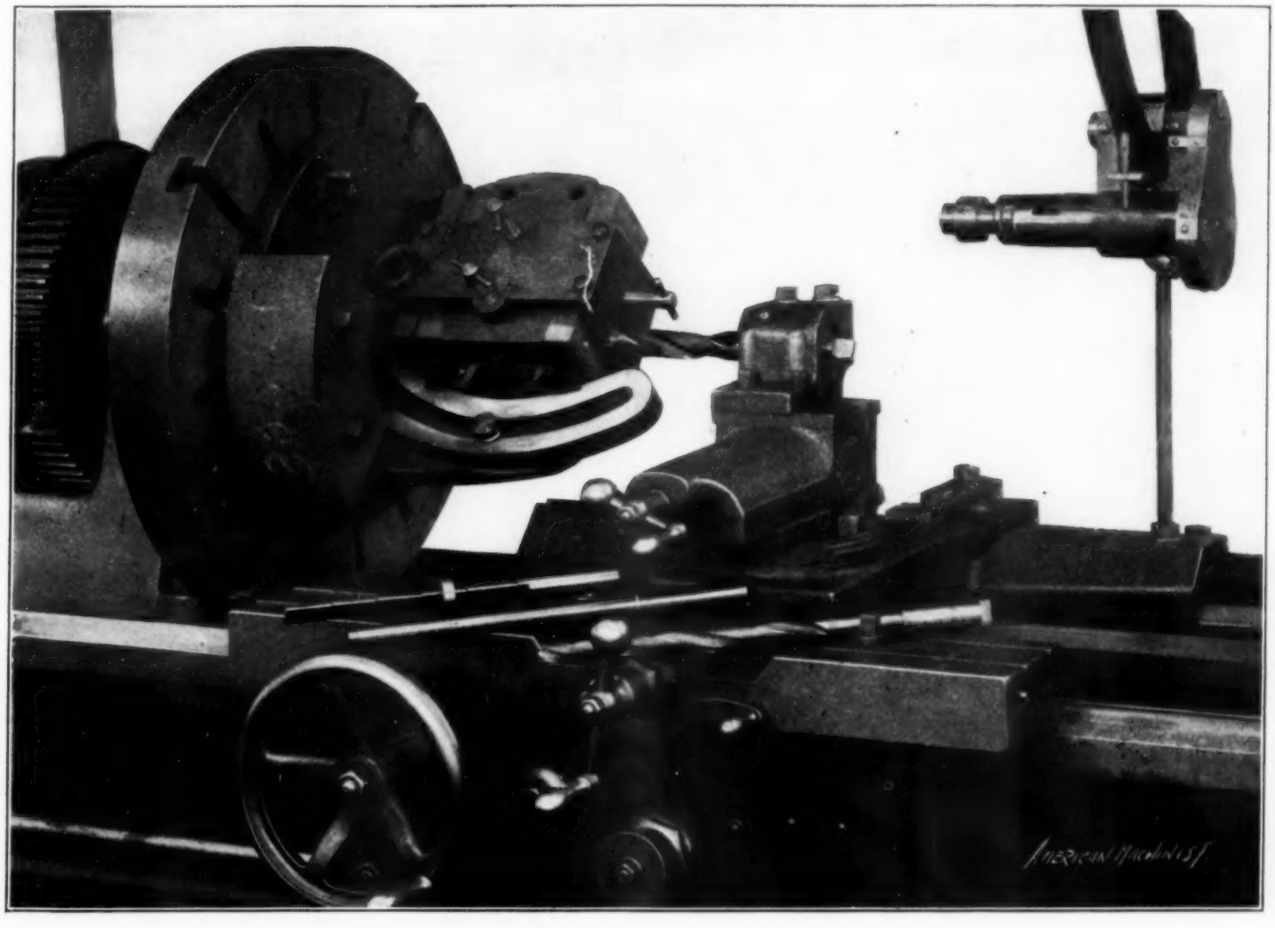


Fig. 1. Fixture for Boring Clapper Boxes with Centering Drill in Place

Preparation of the Clapper Boxes and Blocks

A number of clapper boxes with tool blocks planed and ready for the boring of the taper-pin hole are represented in Fig. 4. In planing, the blocks are first finished to width and thickness, the lugs at the ends facilitating the process of clamping and being easily removed when they have served their purpose. The clapper boxes are then planed and the inside made a good snug fit for the tool blocks. These must fit squarely in place

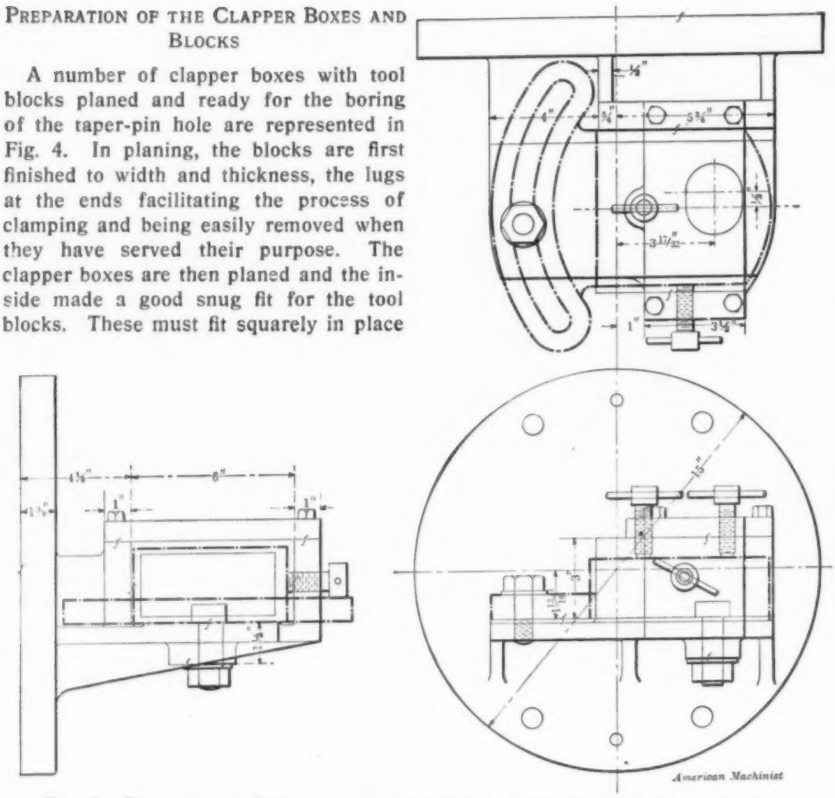


Fig. 2. Fixture for Drilling and Boring Clapper Box and Tool Block in the Lathe

and the test for parallelism of bottom is the application of four pieces of tissue paper, as indicated in the engraving. These tissues must be pinched evenly between the block and box, at the four corners, and they are left in place all through the successive operations of drilling and boring the taper hole, and until the work is ready for the reception of the taper pin.

It will be understood that the method of putting through the taper hole assures an axial position perfectly square with the sides of the clapper block so that the block as it swings up on its pin out of the clapper box, will travel in a plane parallel with the guiding surfaces in the box, and thus avoid binding at either end or corner. The importance of locating the pin hole correctly will be further appreciated when it is remembered that the blocks are already fitted into the clapper boxes and the only scraping that will follow the boring of the taper hole will be a slight touching up to remove the loose iron and possibly ease the fit of the block sufficiently to permit it to swing on its pin without too much friction. This obviously removes any possibility of resort to scraping for the correction of real errors incidental to the boring operation, therefore the boring must be accomplished under conditions that positively assure correct results.

The Drilling Attachment

The first real drilling operation subsequent to the centering process illustrated in Fig. 1 is shown by Fig. 5, which represents the method of applying the special drilling attachment in the running through of the twist drill which is, of course, a little smaller in diameter than the small end of the taper hole to be finished, or in this case, say, 7/8 inch.

When not in use, the drilling attachment is suspended on an arm at the back of the lathe carriage as in Fig. 1; for drilling, the appliance is removed from its standard and slipped into the holder on the compound rest, in place of the centering drill. The belt passes over a drum overhead, and when the attachment is placed in working position it draws the belt tight enough to drive the drill spindle.

A side elevation and section of the device is shown in Fig. 6, and from this it will be seen that the spindle is gear driven from the short pulley shaft at the top; is provided with a ball-thrust bearing; runs in a bronze quill which fits

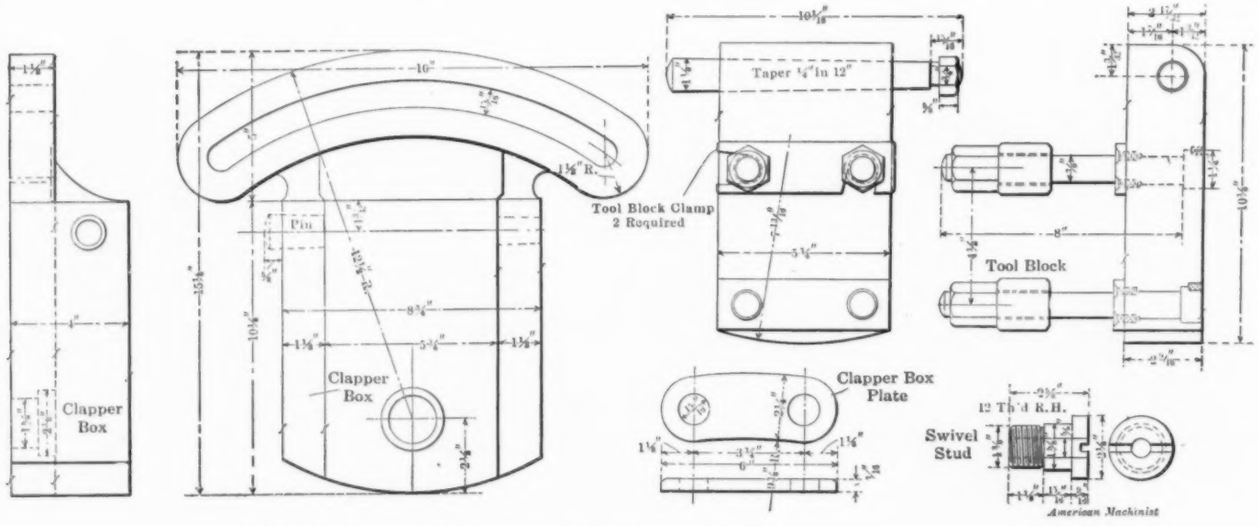


Fig. 3. Clapper-box Details

the holder on the compound rest; and carries a quick-change socket for the rapid insertion and removal of drills. The bracket carrying the gears and pulley is split at the bottom and clamped on the end of the quill as shown. The block on the compound rest is also split at the back and the quill is secured in place by tightening two screws.

High-speed Drilling

The drilling operation in Fig. 5 is accomplished rapidly with the high-speed attachment, the drill itself having a ve-

locity of 320 revolutions per minute, while the work is rotated at 90 turns. The carriage is fed by power and the drill passes through the work in a very few minutes' time. The attachment is then slipped out of its holder and returned to the carrier at the back of the saddle.

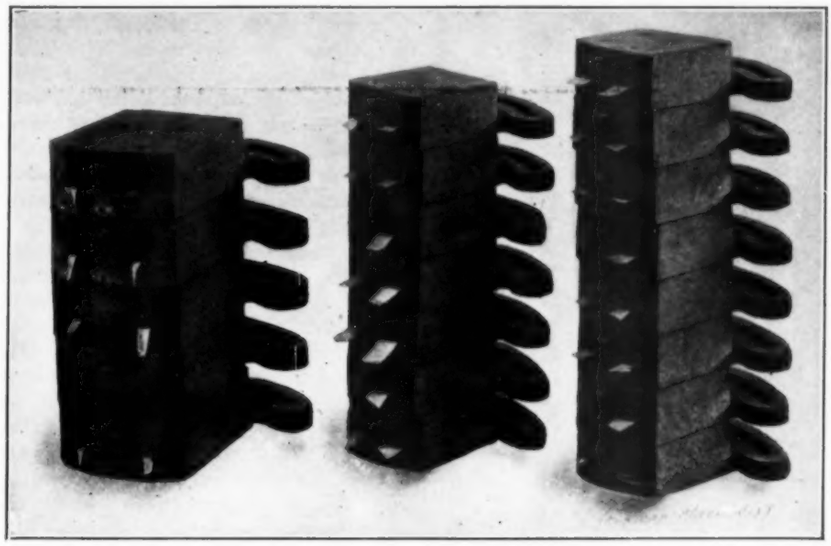


FIG. 4. CLAPPER BOXES WITH TOOL BLOCKS PLANED AND READY FOR BORING FOR TAPER PIN

Following this operation, the hole is enlarged and stepped out to a series of diameters whose successive shoulders approximate the taper required, by means of a flat drill which is illustrated in use in Fig. 7. Three other drills of this kind but of different sizes will be noticed in the tray, Fig. 8, which contains the complete tool outfit for the various sizes of clapper blocks and boxes.

FLAT-DRILL FEATURES

These flat tools have round shanks fitting bushings in the holder on the compound rest, and the steps in each instance are proportioned to suit the length and diameter of the hole. In all cases practically 1/16 inch difference exists between adjacent steps.

Each step is relieved slightly from the cutting edge back, leaving a free working drill, and as it is important that the drill shall not enter the work so far as to interfere with the taper which is to be produced by the boring tool, a stop collar is fitted to each flat drill and a chart is attached to the lathe bed under the head, by means of which the operator can set the stop collar correctly on the flat drill for any size of clapper block. A copy of this chart is reproduced in Fig. 9, and it will be seen from this engraving that the drills are numbered and the collars designated by letters. The fourth column gives the depth the stepped drill is to be run into the work, and the operator has merely to set the proper collar on the drill required, to the distance from the end specified under "Depth."

In use, the collar comes up against the face of the clapper box and with the proper setting there is no danger of the hole being roughed out too deeply to bore out to the required taper.

As the boring operation requires the cross adjustment of the cross slide and compound rest, the central position of the drill holder on the rest is lost each time the boring tool is brought into service and resetting is necessary at the outset upon each piece. This is very easily attended to by merely running the tail center into contact with the center in the end of the shank on the first drill used. The crank for quick traverse of the tailstock is of convenience in this operation.

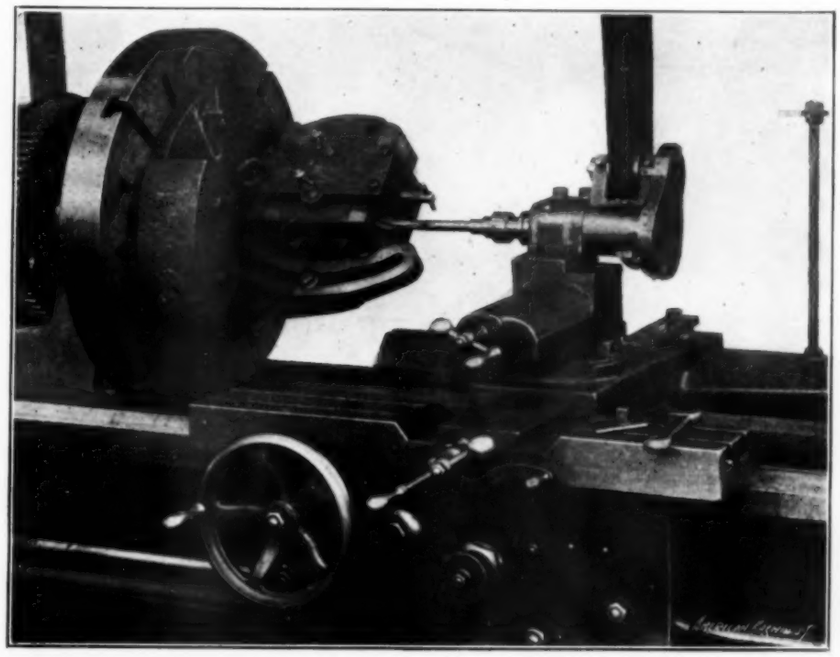


FIG. 5. HIGH-SPEED DRILLING ATTACHMENT IN OPERATION

BORING THE TAPER HOLE

The final machine operation in producing the taper hole is represented by Fig. 10, which shows the boring tool in place and the cross slide connected to the taper attachment.

Three boring tools are included in the outfit in Fig. 8 for different sizes of holes, and as there seen they consist of bars tapered to give the maximum diameter feasible, with a cutting point inserted at the end. Ordinarily three cuts are taken with the boring tool in finishing the hole to its own one-quarter-inch-per-foot taper. The work revolves as in the operations of drilling at about 90 turns per minute.

Factory Sanitation and Efficiency*

BY C. E. A. WINSLOW†

It may fairly be maintained that in most industries the largest element invested is what may be called life capital. For example, in the cotton industry in 1905 there was invested a capital of 613 million dollars, while the payroll amounted to 96 millions a year. Capitalized at 5 per cent., this payroll would correspond to an investment of 1920 million dollars in the form of the hands and brains of the workers. The calculation is perhaps a

*An extract of a paper presented before the Congress of Technology.

†Associate professor of biology, College of the City of New York, and curator of public health, American Museum of Natural History, New York.

fanciful one; but it illustrates the fundamental fact that the human element in industry is of large practical importance.

Once the operative is trained and at work it is generally assumed that the results obtained will depend only on his intrinsic qualities of intelligence and skill. The effect of the environment upon him is commonly ignored; but its practical importance is very great. In industries where it has been shown that the machine which makes a given fabric requires certain conditions of temperature and moisture for its successful operation these conditions are maintained with exemplary care. In every factory, however, there is another type of machine, the living machine, which is extraordinarily responsive to slight changes in the conditions which surround it. These conditions, in this relation, we habitually neglect.

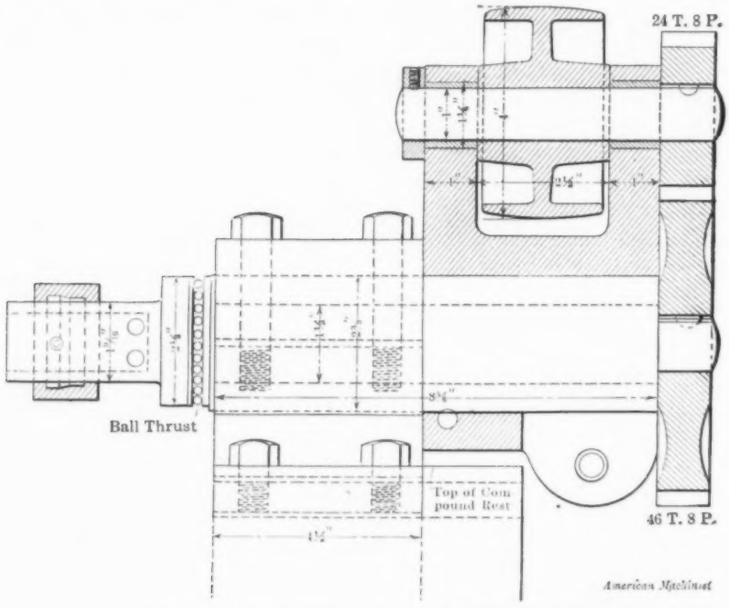


FIG. 6. HIGH-SPEED DRILLING ATTACHMENT

I am not dealing now with the sociological and humanitarian aspects of the case. I am quite frankly and coldly, for the moment, treating the operative as a factor in production whose efficiency should be raised to the highest pitch, for his own sake, for that of his employer and for the welfare of the community at large.

The intimate relation between the conditions which surround the living machine and its efficiency is matter of common experience with us all. Contrast your feelings and your effectiveness on a close, hot, muggy day in August and on a cool brisk bright October morning. Many a factory operative is kept at the August level by an August atmosphere all through the winter months. He works listlessly, he half accomplishes his task, he breaks and wastes the property and the material entrusted to his care. If he works by the day the loss to the employer is direct; if he works by the piece the burden of interest on extra machinery has just as truly to be borne. At the close of the day the operative passes from an overcrowded, overheated workroom into the chill night air. His vitality lowered by the atmosphere in which he has lived, he falls a prey to minor illness, cold and grip and the disturbing effect of absences is added to inefficiency. Back of it all

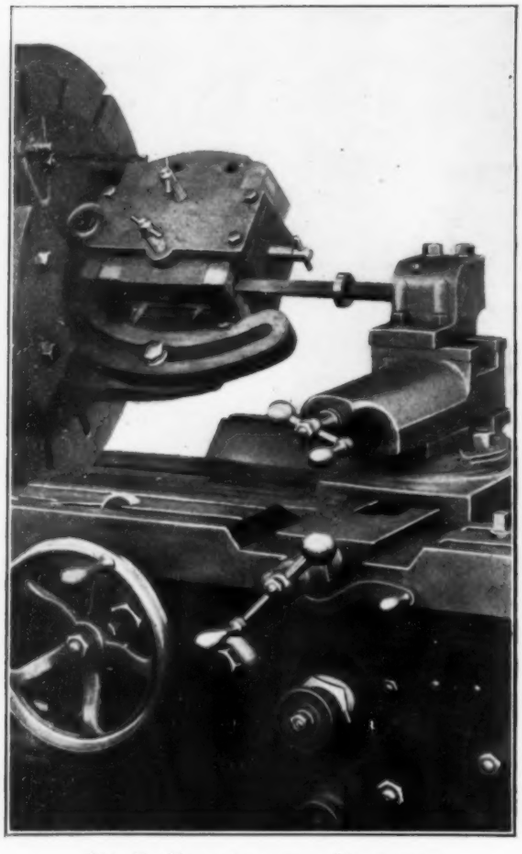


FIG. 7. ENLARGING THE HOLE WITH STEPPED FLAT DRILL

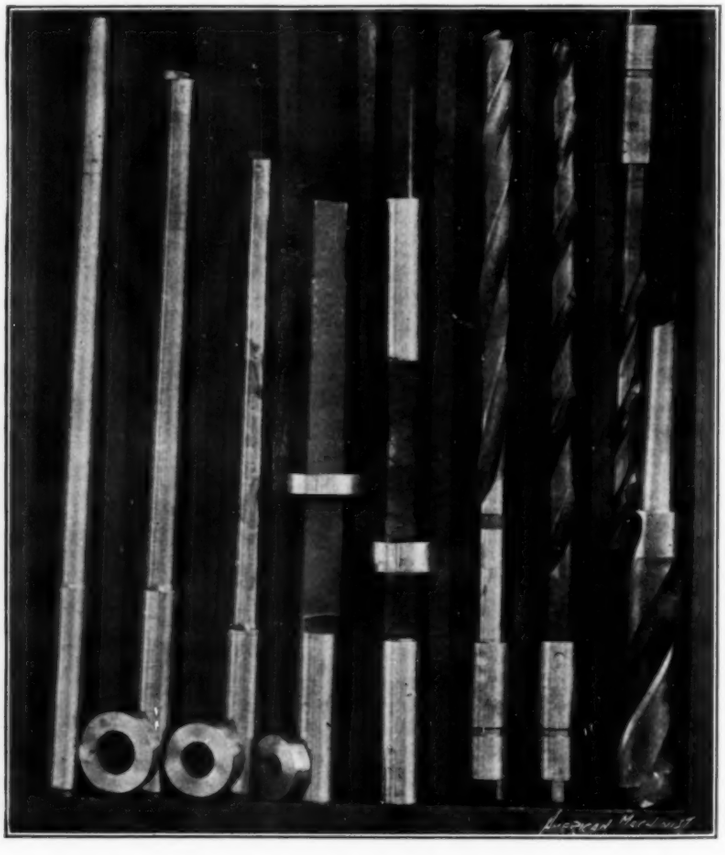


FIG. 8. THE TOOL OUTFIT

lurks tuberculosis, the great social and industrial disease which lays its heavy death tax upon the whole community after the industry has borne its more direct penalty of subnormal vitality and actual illness.

The remedy for all this is not simply ventilation in the ordinary sense in which we have come to understand the term. Conditioning of the air so that the human machine may work under the most favorable conditions—this is one of the chief elements of industrial efficiency as it is of individual health and happiness.

The chief factors in air conditioning for the living machine, the factors which in most cases far outweigh all others put together, are the temperature and humidity of the air. In many a plant money has been spent for an elaborate system of ventilation and if the air has been too hot or too dry or too moist the effect on comfort and efficiency has been worse than *nil*. It is a curious instance of the way

Piece Number	Standard	Side Head	Depth	Drill	Collar
5083	72"		8"	No. 1	*A*
4074	62" x 48"		6¾"	No. 1	*B*
3079	37"		5⅜"	No. 2	*C*
1075	36"		4⅞"	No. 2	*D*
475	24"		3⅜"	No. 2	*D*
284	22"		3"	No. 3	*E*
5320-5321		72"	5⅜"	No. 2	*C*
4295-4296		48"	5⅜"	No. 2	*D*
1324-1325		37"	4⅞"	No. 2	*D*
1324-1325		30"	4⅝"	No. 2	*D*
Right	Left				

American Machinist

FIG. 9. CHART FOR SETTING STOP COLLARS ON FLAT-STEP DRILLS

in which we neglect the obvious practical things and attend to remote and theoretical ones, that for years more attention has been bestowed on the testing of air for carbon dioxide which was supposed to indicate some mysterious danger than on the actual concrete effect of overheating. Yet heat, and particularly heat combined with excessive humidity, is the one condition in air that has been proved beyond a doubt to be universally a cause of discomfort, inefficiency and disease. Flügge and his pupils in Germany and Haldane in England have shown that when the temperature rises to 80 degrees with moderate humidity or much above 70 degrees with high humidity depression, headache, dizziness and the other symptoms associated with badly ventilated rooms begin to manifest themselves. At 78 degrees with saturated air Haldane found that the temperature of the body itself began to rise. The wonderful heat regulating mechanism which enables us to adjust ourselves to our environment had broken down and an actual state of fever had set in. Overheating and excess of moisture is the very worst condition existing in the atmosphere and the very commonest.

The main point in air conditioning is then the maintenance of a low temperature and of a humidity not too excessive. For maximum efficiency the temperature should never pass 70 degrees Fahrenheit and the humidity should not be above 70 per cent. of saturation. At the same time a too low humidity should also be avoided. We have little exact information upon this point but it is a matter of common knowledge with many persons that very dry air, especially at 70 degrees or over, is excessively stimulating and produces nervousness and discomfort. It would probably be desirable to keep the relative humidity between 60 and 70 per cent.

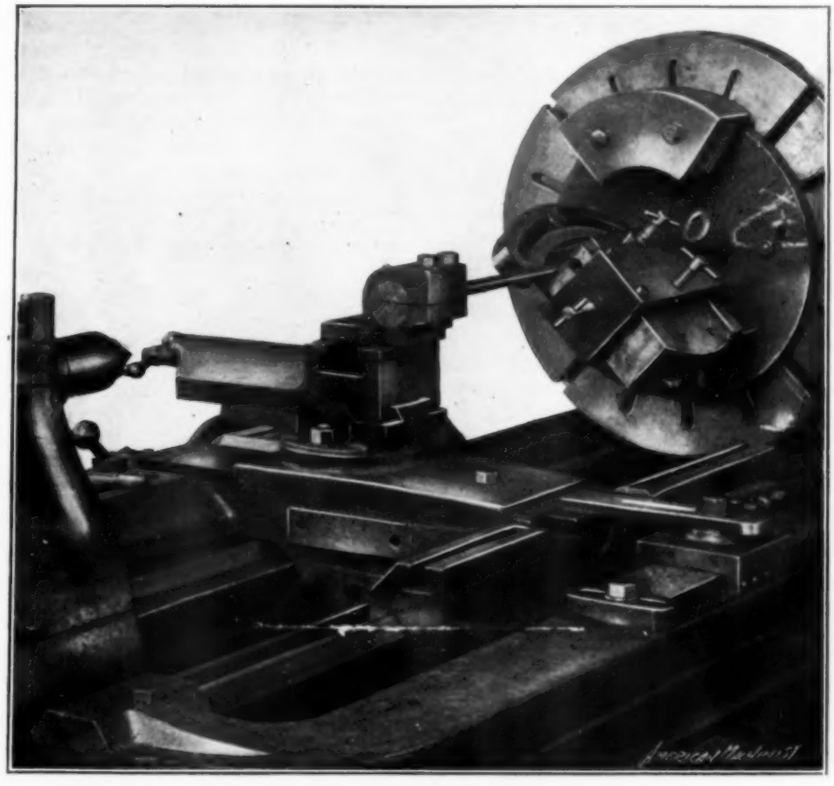


FIG. 10. FINISHING THE HOLE WITH BORING TOOL AND TAPER BARS

Another point which may be emphasized in the light of current opinion is the importance of "perflation" or the flushing out of a room at intervals, with vigorous drafts of fresh cool air. Where there are no air currents the hot moist vitiated air from the body clings round us like an "aërial blanket" as Professor Sedgwick calls it, and each of us is surrounded by a zone of concentrated discomfort. The delightful sensation of walking or riding against a wind is largely perhaps due to the dispersion of this foul envelop and it is important that a fresh blast of air should sometimes blow over the body in order to produce a similar effect. The same process will scatter the odors which have been noted as unpleasant and to some persons potentially injurious. The principal value of the carbon dioxide test today lies in the fact that under ordinary conditions high carbon dioxide indicates that there are no air currents changing the atmosphere about the bodies of the occupants.

In dusty trades, like stone cutting and cutlery working and emery grinding, 75 per cent. of all deaths among the operatives are often due to tuberculosis, against 25 per cent. for the normal adult population. This may be fairly interpreted as meaning that the actual death rate from tuberculosis in these trades is from two to four times as high as in a corresponding average population; in other words, 3 or 4 or 5 out of a thousand of these workers are sacrificed every year to the conditions under which they labor. The elimination of the dust by special hoods and fans is imperative in such industries and must be supplemented in extreme cases by the compulsory use of respirators.

It is extraordinary how little is known today of the actual conditions of factory air, either by manufacturers or by sanitarians. So far as I am aware, the New York Department of Labor is the only State department dealing with factory inspection which collects and publishes exact data in regard to the quality of the atmosphere in the workshops. If the conditions indicated in these reports by Dr. C. T. Graham Rogers are typical, and there is no reason to doubt that they are for the smaller industries, at least, there is urgent need for betterment. A table compiled shows that 215 workrooms in-

spected, 156 or 73 per cent. had a temperature of over 72 degrees, and 63 or 29 per cent. exceeded 79 degrees. Relative humidity exceeded 70 per cent. in 39, or 18 per cent. of the workrooms. In tabulating these analyses I have excluded all cases where the outdoor temperature was over 70 degrees.

There is plenty of evidence, though of a scattered and ill-digested sort, that the elimination of such conditions as these brings a direct return in increased efficiency of production. The classic case of the U. S. Pension Bureau is always quoted in this connection. The removal of the offices of the department from scattered and poorly ventilated buildings to new and well ventilated quarters, reduced the number of days of absence due to illness from 18,736, in the neighborhood of which figure it had been for several successive years, to 10,114.

In an investigation of my own of conditions in the operating room of the New England Telephone and Telegraph Company, at Cambridge, Mass., I found that before the installation of a ventilating system, 4.9 per cent. of the force (50 to 60 girls) were absent during the winter months of 1906, and 4.5 per cent. in 1907. The ventilating duct which was put in was a simple one and cost only about $75 to install, but in the winter of 1908 following its introduction, the absences were cut down to 1.9 per cent. of the force employed, without any other change in conditions or personnel, so far as I was able to discover.

"The vice-president of the Manhattan Trust Company, of New York, states that by proper ventilation he has so increased the efficiency of his clerical force that he has been able to reduce the number of employees 4 per cent.

"In the printing establishment of C. J. O'Brien, in New York, a ventilating system was installed because of the insistence of the State Department of Labor that the law be complied with, the order having been resisted for two years. After a system had been in use a year the proprietor stated that had he known in advance of the results to be obtained, no order would have been necessary to have brought about the installation. Whereas formerly the men had left work on busy days in an exhausted condition and sickness was common, now the men left work on all days in an entirely different condition, and sickness had been very much reduced. The errors in typesetting and time required for making corrections were greatly reduced.

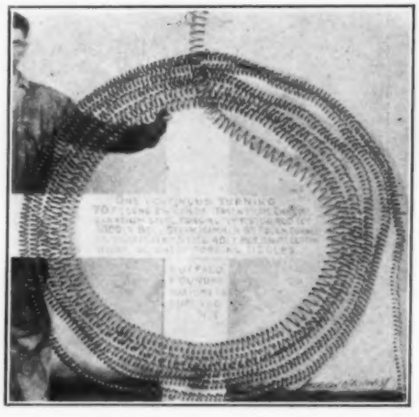
"Townsend, Grace & Co., of Baltimore, built a straw-hat factory without ventilating apparatus. The first two winters after occupation the sick rate was 27½ per cent. A ventilating system was then installed, after which the winter sick rate fell to 7 per cent. It was claimed that the ventilating system paid for itself in one year."

The consulting factory sanitarian will be a new factor in industry, but the progress of industrial economy and of sanitary science unite in pointing to the need for such an expert. If the manufacturers of New England will fully utilize the resources of the Massachusetts Institute of Technology in this direction, they can write a new chapter in the history of industrial efficiency.

An Interesting Chrome Vanadium Steel Chip

By D. Bell*

The accompanying halftone shows a rather remarkable chip or turning in one continuous piece, 70 feet long. The outside diameter of the coil measured from 2½ inches in diameter when the chip was started, down to about 1⅜ inches in diameter when it finally broke off from the rod, which was being turned. The material being turned was a chrome-vanadium steel forging, which was used for the piston rod for a 3000-pound Bell single-frame hammer.



Chip Taken on a Chrome-Vanadium Steel Forging

The forging, after being carefully heat treated, was rough turned to 6½ inches in diameter, and the chip shown was taken off in reducing the rod to 6 5/16 inches diameter. The feed was about 1/12 inch per minute, and the cutting speed was 40 feet per minute; the weight of the forging was 1100 pounds. It had the piston head forged solid on to the rod part, which was turned to fit the cylinder 15 inches bore, and grooved for the special weldless steel-forging piston rings used in these hammers.

In view of the study which is being put on the question of the proper use, and the advantages to be obtained from such use, of various alloy-steel forgings, this chip may be of timely interest.

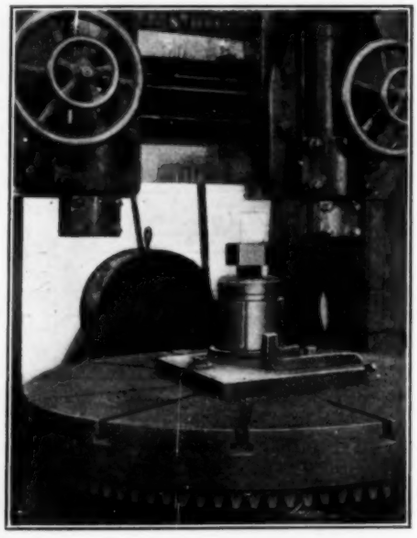
*Engineer, Buffalo Foundry and Machine Company.

Eccentric Mandrel

By J. H. Tinker*

Accompanying is a halftone of an eccentric mandrel. I have seen a number of mandrels for turning eccentrics, but for quick adjustment and simplicity I believe this is the best. It has a cast-iron base with ribs on bottom, these ribs planed to fit the T-grooves in the table of the boring mill neatly. The mandrel proper is turned taper with a large nut and washer on the end. For the different size axles cast-iron bushings are used, finished straight on the outside and tapered to suit mandrel on the inside.

One edge of the base is planed true and



Mandrel for Turning Eccentrics

lines up with a line drawn on the table when absolutely central. In giving the different throws of eccentrics, there are other lines on the table plainly marked and the finished edge of base simply is moved over parallel with the proper line of throw desired.

Previous to the use of this tool, the method of turning eccentrics was to have each one laid off by placing a wood center in the axle hole and then drawing a line for throw; setting each eccentric on strips. By the use of this mandrel we reduced the time about 1½ hours on a set.

We also experienced a great deal of trouble on account of loose eccentrics, causing quite a number of engine failures. To overcome this we placed cardboard about the thickness of 1/32 scant, between the two halves of eccentric before boring for axle fit. When these cards are removed the eccentric clamps the axle tightly, preventing it from slipping after set screws have been properly screwed down. Since adopting this method we have had no reports of loose eccentrics.

The mandrel shown was designed by W. A. Swan, machine foreman.

*Master mechanic, C. & E. I. R. R., Danville, Ill.

Making Crank and Transmission Cases

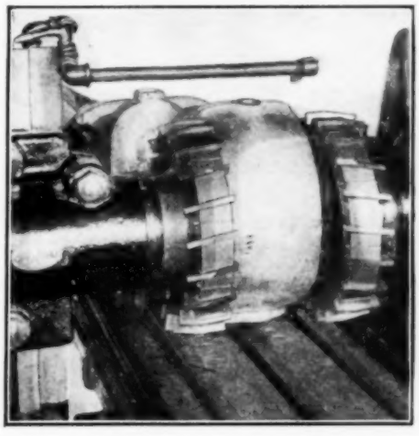
Editorial Correspondence

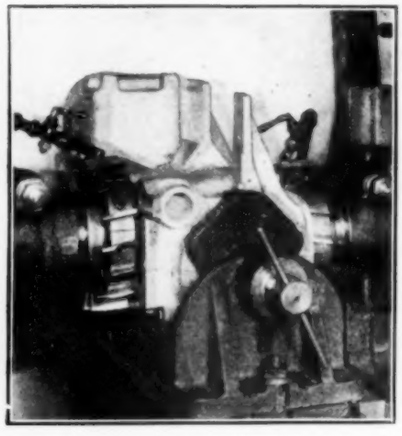
Using Lincoln type milling machines for transmission cases; the use of boring bars in the lathe; shifting face plate fixtures and a special device for turning cam shafts.

Figs. 1 and 2 show very similar milling operations on crank and transmission cases in a type of milling machine that is not as common as it should be in automobile shops. This is practically a double-head Lincoln miller, having spindles sufficiently large to carry good-sized cutters for surfacing work. The transmission case is held entirely by its front end, while the large inserted-tooth cutters finish the guide openings which receive the bells on the half rear axles.

The crank case is also being milled simultaneously on both sides on a similar machine, being held in the fixture shown, which centers it by the ends and supports it from beneath.

The case is located by its open end, which has been faced off in Fig. 3, and the case is held against this flat surface by the clamping screw in front, having the locating fork which fits the rounded portion of the case.





FIGS. 1 AND 2. FACING CRANK AND TRANSMISSION CASES

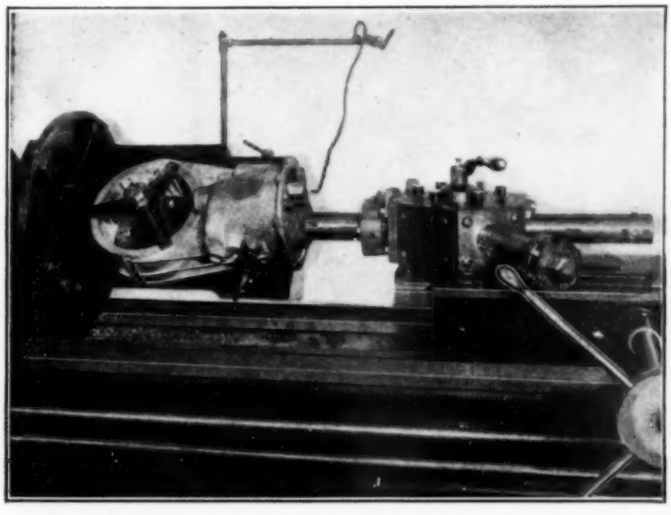


FIG. 3. SHIFTING FACE-PLATE DEVICE FOR TRANSMISSION CASES

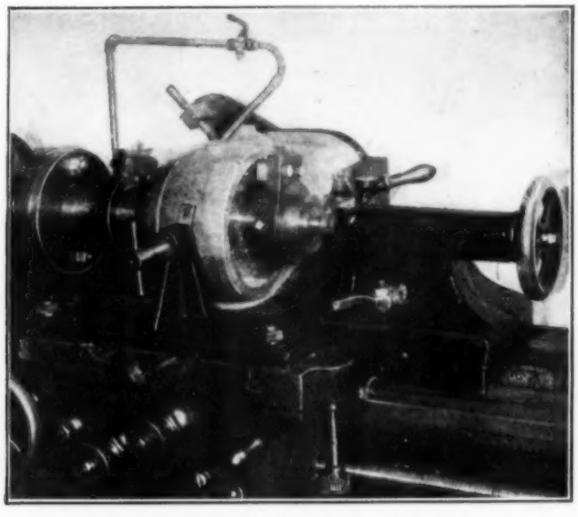


FIG. 4. BORING TRANSMISSION CASES

BORING IN THE LATHE

The next operation on the transmission case is shown in Fig. 3, where a Lodge & Shipley lathe has been fitted with a special saddle for the carriage and special boring bars for finishing the holes on each end to the desired size.

The boring tool at the left has just entered the opening in the gate, and following this is an arm carrying the clamping tools shown. On the other end is a square-cornered tool for cutting down the metal on the outside of the case. The carriage gives the desired feed in either direction.

Fig. 4 shows the transmission case after it has been bored to receive the bell for the axle. This is located on the angle plate by a plate and clamped by the three-cornered clamp and the locating screws shown. As shown, it is being bored for one of the gear-box shafts, the tool next the turret being for finishing the outer end and having adjustable cutters.

After it has been bored in this position, the whole angle plate is shifted across the face plate and the hole for the other transmission shaft bored. The boring tools are shown.

A FACE-PLATE FIXTURE

Another somewhat similar face-plate fixture is shown in Fig. 5, where the covers for the transmission cases are being machined. As shown, the lathe tool is facing off the cover for the joints. While in this position the hole for one of the gear-shaft bushings is also bored and reamed by the tools shown.

The chuck carrying the work is then shifted across the face plate so that the two stops make contact and the piece is then in the correct position to be bored for the other transmission-shaft bushing.

Fig. 6 shows the crank case being bored on a LeBlond lathe, having a special saddle for the carriage. This locates the crank case by its finished surfaces by means of a swinging lid and the jack screws shown.

The openings for the crank-shaft bearings are then bored by the special boring head shown while the large facing cut-

ters with inserted blades, face the ends of the crank cases.

This same operation is performed at both ends of the crank case, the long boring bar being only necessary for one end.

Boring a Crank Case

Fig. 7 shows the crank case mounted on another fixture so that the cam-shaft hole can be bored in its correct position. The crank case is located by the end plate shown, these fitting in the hole previously bored by the tools in Fig. 6. After being located the crank case is held in place by a simple bar and jack screw shown. Both of these lathes are fitted with headstocks at each end so that the cutting tools can be independently driven.

Turning Fixture for Cam Shafts

Fig. 8 shows a cam shaft. This shows a special saddle bolted to the lathe carriage carrying three tool blocks on the backside. These tool blocks are adjustable with regard to the work by the gear and rack shown in the right-hand block. This makes it easy to feed the tool in for facing down on the sides of the cams, the cam-shaft being supported by the blocks in the tool post, to be moved to any desired position.

The cam shafts are afterward finished by grinding, so that this is only a roughing-out fixture.

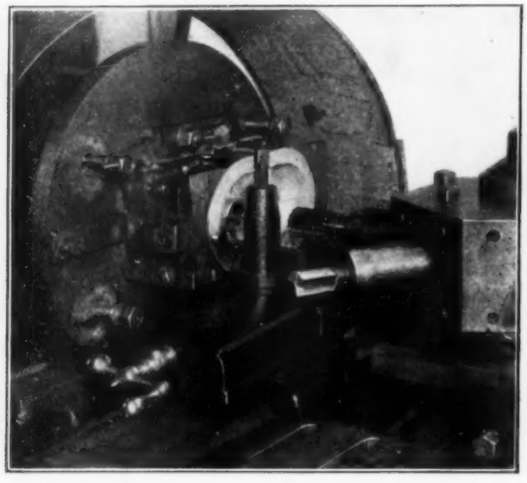


Fig. 5. Another Shifting Face-plate Fixture

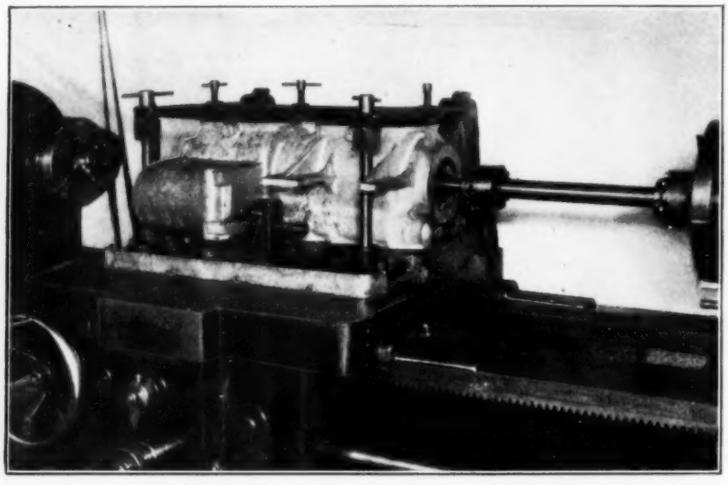


Fig. 6. Boring Crank Cases in Lathe

Turning Large Wooden Pulleys

By Herbert Beard

We recently had to make two wooden pulleys, 48 and 52 inches in diameter, and not wishing to shut down the mill to turn them in place, yet not having a lathe large enough to swing them, though we had a 20-inch lathe and a 24-inch drill press, we proceeded as follows: We first centered each half in the drill press and bored it with a fly cutter, in the meanwhile having a mandrel turned up with a threaded end and a nut on it to fit the tool-post slot of the lathe. We then placed collars or washers below the pulley on the mandrel, so as to bring it up to center; next we mounted two gouges in opposite jaws of the chuck, making a Daniels planer of the headstock; then by revolving the pulley by hand and feeding in the carriage, we trued up the face, finding that by running the cross slide in or out we could get any amount of crowning we wanted.

We turned the edges by raising the pulley on the mandrel and using a fly cutter mounted in an arbor.

On assembling, we found that the pulleys ran perfectly true and the job took much less time than if we had rigged up to turn them on the shaft, besides making a much smoother job and it made an elliptical crowning far superior to the ordinary.

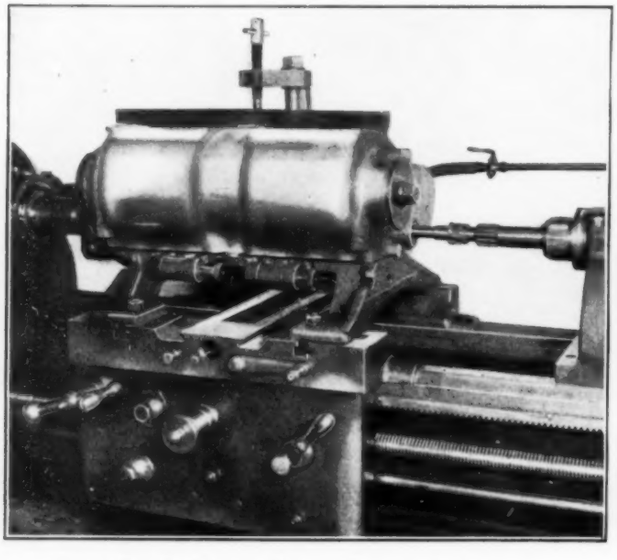


Fig. 7. Boring Crank Case in Lathe

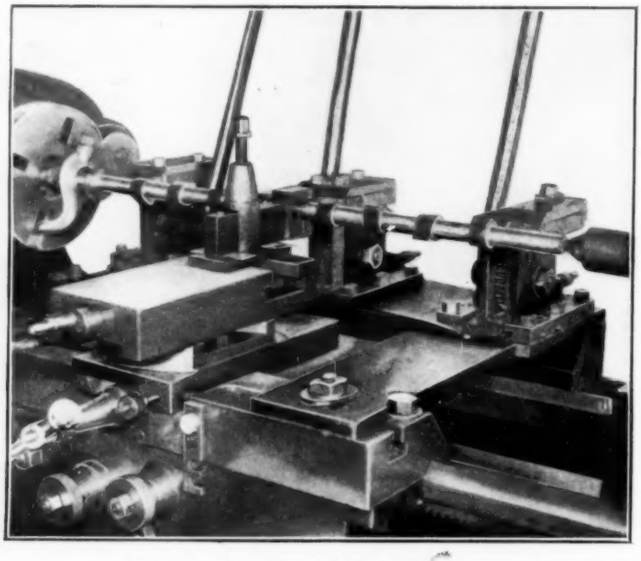


Fig. 8. Cam-shaft Turning Fixture

Differential Indexing on the Miller

By G. H. Longworth*

A convenient method of determining the ratios of gear wheels required to give the index plate the necessary rate of movement for any number of divisions not obtainable by simple indexing.

Derivation of the formula and statement of a simple rule whereby any number that can be divided by simple indexing is used as a basis for finding the gears required to index for a given number which must be obtained by the differential method.

Application of the method to fractional spacing, with typical examples worked out to illustrate the principle.

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The differential system of indexing is now extensively used on all modern types of milling machines, but, so far as I have been able to judge, the reasoning on which this system is based, is not by any means clear to the average milling-machine operator.

This fact, in itself, provides a sufficient reason for presenting the subject matter in a simple manner, capable of being readily understood by anyone having occasion to use this particular system of indexing; to make the matter quite clear, however, it will be advisable in the first case to refer to the simple or direct system of indexing; and, without entering into the details of the construction of the spiral head used for this purpose, the general arrangement of the dividing mechanism may be shown from the accompanying diagrammatic sketches:

The Indexing Mechanism

In Fig. 1 the worm wheel A is secured to the main spindle of the spiral head and rotated by means of the worm shaft and single-threaded worm B. The index plate (having rows of equally spaced holes) remains stationary during the dividing operation, and is fitted with adjustable sector arms, which obviate the necessity of counting the number of holes through which the index crank requires to be moved each time a division is made on the surface of the work. The standard ratio between the worm B and the wormwheel A is 1:40; and to find the movement of the index crank for any required division, the following formula is employed: The movement of the index crank $= \frac{40}{N}$ where N is the number of equal divisions required.

Verifying the Rule

This rule may be readily proved from the well known equation for a simple train of wheels:

$$\frac{\textit{The revolutions of the last wheel}}{\textit{The revolutions of the first wheel}} = \frac{\textit{The number of teeth in the driver}}{\textit{The number of teeth in the follower}}$$

In Fig. 1. A is the worm wheel or follower; B is the worm or driver.

The revolutions of B = the movement of the index crank; the revolutions of A = the required division of the work, and is $\frac{1}{N}$ where N equals the number of divisions. Then

$$\frac{\textit{The revolutions of } A}{\textit{The revolutions of } B} = \frac{\textit{Teeth in worm } B}{\textit{Teeth in worm wheel } A} = \frac{1}{40},$$

that is 40 revolutions of A = the revolutions of B; but the required revolutions of $A = \frac{1}{N}$, and the revolutions of B = the movement of the index crank; $\therefore \frac{40}{N}$ = the movement of the index crank.

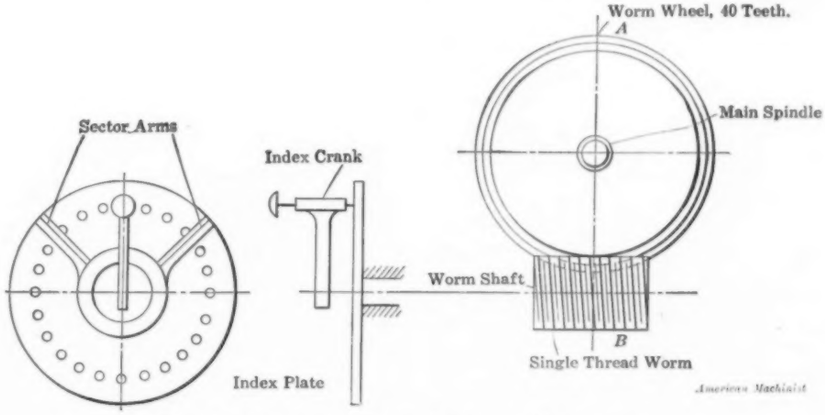

Fig. 1. Diagram of Plain Indexing Mechanism

An Example

Example: Let it be required to divide the circumference of a piece of work into 48 equal parts.

The movement of the index crank for each division $= \frac{40}{48} = \frac{5}{6}$ *revolutions.*

An index plate having a row of 18 holes would be chosen, and the sector arms set to limit the movement of the index crank to 15 spaces for $\frac{5}{6} = \frac{15}{18}$.

The number of equal divisions which may be obtained by simple indexing (with the index plates usually provided by milling-machine makers) is strictly limited, and does not meet all the requirements called for in practice. For instance, by this method all equal divisions up to 50 may be obtained, whereas from 50 upward to 100 only those divisions which are equal numbers (with the few exceptions of which 5 is a factor) may be indexed for, and for numbers greater than 100 the divisions possible by this system are still further limited, hence the reason for another method which will enable those divisions which cannot be obtained by the direct means, to be indexed for.

General Principle of Differential Indexing

Differential indexing provides the most convenient way of overcoming this difficulty. In this system the dividing operation is performed as in simple indexing, the only difference being that the index plate instead of remaining stationary during the process of indexing, is made to move relatively to the index crank, being connected to the main spindle of the spiral head by a set of change gears, which may be arranged to give either a *positive* or *negative* movement to the index plate; whichever is found necessary to determine the *actual* motion which must be given to the index crank in order to satisfy the equation used for simple indexing:

$$\textit{Actual movement of the index crank} = \frac{40}{N}.$$

The diagram, Fig. 2, will serve to give

an idea of the arrangement of the gearing, which is adopted in differential indexing.

Relation of the Gearing

For any movement of the index crank the motion is transmitted to the index plate (which is free to rotate on the worm shaft) as follows: The index crank drives through the worm shaft and worm B to the worm wheel A, which in turn transmits the motion through the change gears, spiral wheels and equal gears, the last of which is connected directly to the index plate. The last pair of gears being equal and driven through equal spiral gears, whatever number of revolutions are given to the wheel E, the index plate will make the same number. It will therefore be convenient to consider the revolutions of the wheel E, as the revolutions of the index plate in all subsequent calculations.

As previously mentioned, the index plate being free to rotate on the worm shaft, it will have a motion imparted to it which is directly proportional to the value of the wheel ratio $\left(\frac{C}{E}\right)$; and also to whatever movement is given to the index crank.

Let us then proceed to find the rate of movement of the index plate, as compared with that of the index crank.

Relative Motions of Index Plate and Crank

The index crank being the driver, the motion of E may be obtained from the equation for a compound train of wheels, viz:

$$\frac{\textit{The revolutions of the last wheel}}{\textit{The revolutions of the first wheel}} = \frac{\textit{The product of the teeth in the drivers}}{\textit{The product of the teeth in the followers}}.$$

Now the revolutions of the index plate = the revolutions of the last wheel E, and the revolutions of the index crank = the revolutions of the first wheel, which in this case is the worm B; this is also a driver, the worm wheel A being the follower. C and E are respectively driver and follower for the set of change gears.

The above equation now becomes:

$$\frac{\textit{The revolutions of the index plate}}{\textit{The revolutions of the index crank}} = \frac{\textit{Worm } (B)}{\textit{Worm wheel } (A)} \times \frac{C}{E},$$

$$\frac{\textit{The revolutions of the index plate}}{\textit{The revolutions of the index crank}} = \frac{1}{40} \times \frac{C}{E},$$

but $\frac{C}{E}$ = the wheel ratio; therefore

$$\textit{The revolutions of the index plate} = \left(\frac{1}{40} \times \textit{wheel ratio}\right) \times \left(\textit{the revolutions of the index crank}\right).$$

From the last statement it will be seen that whatever motion is given to the index crank, the motion of the index plate will be 1/40 of this motion multiplied by the value of the wheel ratio. That is:

If $\frac{40}{N}$ = the revolutions of the index crank, then

$$\textit{The revolutions of the index plate} = \frac{40}{N}\left(\frac{1}{40} \times \textit{wheel ratio}\right);$$

Therefore

$$\textit{The revolutions of the index plate} = \frac{1}{N} \times \textit{wheel ratio}.$$

Consideration of the Actual Movement of Crank

Having determined the relative motion of the index plate to that of the index crank, the *actual* motion of the latter will be clearly seen from a reference to Figs. 3 and 4, assuming that in both cases the index setting for the sector arms and the value of the wheel ratio is the same, the index crank being moved in a clockwise direction.

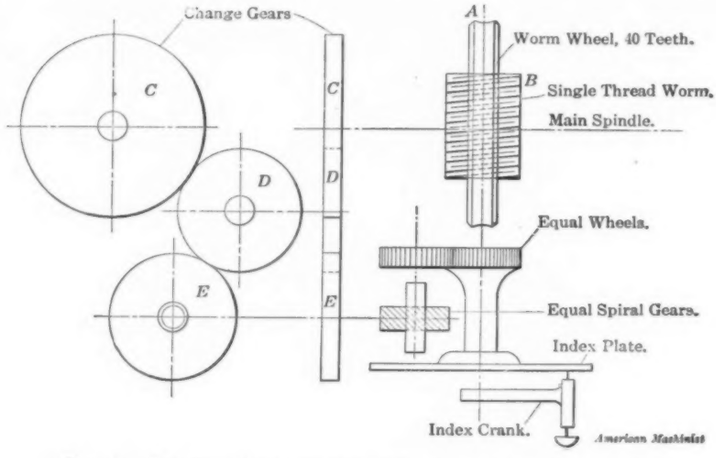

Fig. 2. Gearing Attachment for Differential Indexing

In Fig. 3 the index crank moves from the position (a) to (b) and describes the angle ϕ, the gearing in this case being arranged to move the index plate in the *same direction as the index crank* or in a *positive direction*, the sector arms moving from their initial position, shown by the full lines, to their final position, indicated by the dotted lines.

In Fig. 4, however, the gearing being arranged to move the index plate in a direction *opposite to that of the crank* or in a *negative direction*, the sector arms will recede to the position shown dotted, the *actual* movement of the index crank in this case being from (a_1) to (b_1), the angle ϕ described being considerably less than in Fig. 3.

From the above consideration it should be clear that the *actual movement of the* index crank is a combination of:

The value of the index setting of the sector arms and the movement of the index plate which, from Figs. 3 and 4, may be either *positive* or *negative*.

Hence:

The actual movement of the index crank = index setting ± the movement of the index plate.

The plus sign in the above equation would be used when the movement of the index plate is in the *same* direction as the crank or *positive*, and the *minus* sign when the index plate has a *negative* movement.

The Equation for Differential Indexing

The actual movement of the index crank gives the required division of the work, and for any case would be $\frac{40}{N}$.

The movement of the index plate for any movement of the index crank = $\frac{1}{N}$ × wheel ratio.

For the index setting of the sector arms the ratio $\frac{40}{N}$ would be used for simple indexing, but in the "differential system" this does not represent the actual movement of the index crank that is required, therefore, substituting (n) in the above ratio for (N), $\frac{40}{n}$ will determine the setting of the sector arms, where (n) is the number chosen to obtain their position, as shown in Figs. 3 and 4. (This number (n) must be one which can be obtained by simple indexing.)

The equation for "differential indexing" may therefore be written:

$$\frac{40}{N} = \frac{40}{n} \pm \frac{\textit{wheel ratio}}{N}.$$

This equation can be used, first choosing a suitable value for (n) and solving to find the wheel ratio.

It should also be noted that for the same division numerous values may be found for the wheel ratio, depending on the value assigned to (n); the possible combinations of the gearing being only limited by the range of wheels at our disposal.

A Simpler Form

By changing the form of the above equation, a much more simple and easy rule to remember may be obtained, thus:

$$\frac{40}{N} = \frac{40}{n} \pm \frac{\textit{wheel ratio}}{N}.$$

Let

$x =$ the wheel ratio;

then

$$\frac{40 \pm x}{N} = \frac{40}{n};$$

therefore

$$n40 \pm nx = 40N$$

and

$$40(n - N) = \pm nx.$$

Therefore

$$(n - N)\frac{40}{n} = \pm x.$$

That is to say:

The difference of the two numbers n and N multiplied by the value of the index setting equals the wheel ratio. The *plus* or *minus* value found for x will determine the direction of motion of the index plate and, as before mentioned, will be *positive* for the *plus* and *negative* for the *minus* sign.

Application of the Formula

To illustrate the use of this formula, let 63 equal divisions be required. The problem is now to determine the value of the wheel ratio and the setting of the sector arms. Choosing any number for (n) which may be either *greater* or *less* than 63, and which can be obtained by simple indexing, say, 60, then:

$$(n - N) = (60 - 63) = -3.$$

This number (-3), when multiplied by the value of the index setting, will give the wheel ratio.

$$\textit{Index setting} = \frac{40}{60},$$

then

$$(n - N)\frac{40}{n} = -3 \times \frac{40}{60} = -\frac{60}{30} \textit{ wheels required}$$

The wheels 60 and 30 are respectively driver and follower, and the gears would be arranged to give a *negative* movement (*opposite to the crank*) to the index plate, as the wheel ratio found has a *minus* value.

The sector arms would be set to $\frac{12}{60} = \frac{12}{18}$ or 12 spaces on an index plate having a row of 18 holes, the indexing being performed in the usual way by removing the index crank between these limits for each division.

The Rule for Wheel Ratio

From this example the rule to be adopted in finding the wheel ratio may be defined as follows:

First choose any number, obtainable by simple indexing, and index for this in the usual manner. The difference between the number chosen and the number of divisions required when multiplied by the value of the index setting gives the wheel ratio. If the number chosen for (n) is *less* than the number of divisions required (N), then the index plate will have a *negative* motion, and conversely if (n) is greater than (N), the index plate will have a *positive* motion.

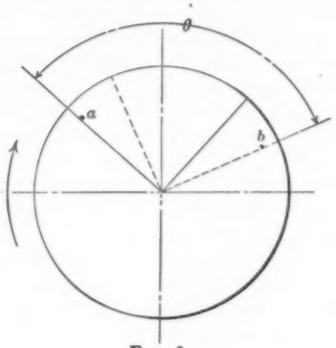

Fig. 3

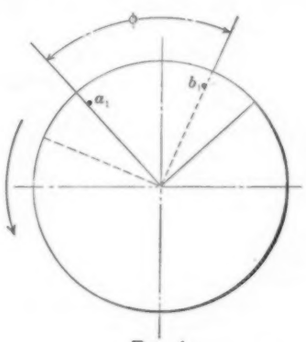

Fig. 4

American Machinist

Index Crank and Plate Movement

In Fig. 2 a simple train of wheels is shown for the change gears; these, of course, may be compounded if desired, and the example which follows will be worked out on this assumption.

Fractional Spacing

Up to the present only those divisions which are equal parts of a circle have been considered. The differential system can also be applied to find divisions other than equal parts of the circle, the operation being then spoken of as "fractional spacing." Take an example of this kind:

On the Starrett bevel protractor the main scale is graduated in degrees, and has a vernier scale attached, enabling divisions of 1/12 of a degree, or 5 minutes to be obtained. This result is arrived at by allowing 23 divisions or degrees on the main scale to coincide with 12 graduations on the vernier scale, so that the value of one graduation on the vernier scale is $\frac{23}{360} \div 12$, or the total number of divisions in the complete circle would be $\frac{12 \times 360}{23}$ *or* $187\frac{12}{23}$.

Application of the Differential Indexing Rule

Applying the rule for differential indexing:

Let 180 be the number chosen, the index setting will then be $\frac{40}{180}$, and the difference between the two numbers will be $7\frac{12}{23}$, and the wheel ratio $7\frac{12}{23} \times \frac{40}{180} = \frac{180}{23} \times \frac{40}{180}$, therefore

$$\textit{Wheel ratio} = \frac{40}{23}.$$

Assuming a compound train of wheels is required:

Factorizing the wheel ratio and multiplying to bring within the compass of whatever change wheels are supplied;

$$\frac{40}{23} = \frac{5 \times 8}{4.6 \times 5} = \frac{100 \times 64}{92 \times 40} \textit{ wheels required.}$$

The wheel ratio will have a *minus* value, for 180 is less than $187\frac{12}{23}$, hence the index plate must be geared to have a *negative* motion.

Choosing Special Gears

With the ordinary change wheels supplied it is very unlikely that a wheel having 92 teeth will be contained in the set, so that it would be necessary to have this wheel made, as the denominator of the wheel ratio (23) is not a factor of any of the regular wheels, and being a prime number is difficult to deal with.

Cases of this kind, where a special wheel is required to be made, do not often arise, and when such do occur it is advisable to choose a wheel which is most likely to prove useful for other work; that is, cutting of spirals, etc. The wheel of 92 teeth has been chosen on this account in preference to one having 46 teeth or 23 teeth, either of which would have met the requirements of the above case.

Final Observations

It may be observed by some readers who are acquainted with the differential system of indexing, that no reference whatever has been made to the "index spacing number."

In my opinion, the use of this term is rendered unnecessary by the treatment accorded to the subject in the preceding statements.

In conclusion attention should be drawn to the importance of eliminating all backlash during the operation of indexing, as, due to the combination of gearing which is adopted, if the index crank overshoots the pin hole, even only slightly, and is then moved back to the required position, a serious error may result. This may be avoided by moving the crank backward sufficiently to take up any lost motion, and then approaching the pin hole cautiously. Given proper attention to the meshing of the change gears, and exercising care during the indexing operation, no trouble is experienced in producing accurate work by this method.

What Is the Law in the Case?

By W. Osborne

A question that came up in Sammy's shop about the legality of buying a $2.50 alarm clock for 65 cents when the package says it cannot be used if less than full price is paid.

It was noon hour and a number of men were grouped together discussing something with evident interest as Sammy came along.

As it seemed to be an open gathering, he stopped to see what it was that was keeping the men from pitching quoits and throwing the ball, or from telling those who were doing these things how they should be done.

"What is the excitement this time?" Sammy asked the man nearest to him

"We are floundering around in the deep and unknown waters of the law, and I guess that most of us are over our heads," replied the man. "Ray started it."

Ray held up his hand. Hanging on one finger by a string was a round ticket with $2.50 marked on it in figures that could be read 20 feet away. "This price tag," said he, "is what started us going."

"Is it intended as a test for eyesight?" asked Sammy.

"Not in the usual way, anyhow," Ray answered. "It is the other side that has the goods on." He swung the tag around and Sammy saw that there was some very fine printing on the other side. He took the tag in his hand and moved it to get a favorable light on it so that he could read it. While he was doing this Ray continued, "I came in late one morning, and when I told the foreman that the alarm clock didn't work, he hinted that it would be a wise thing for me to get a good alarm clock. I had been thinking the same thing, for the one I had was an old one that cost 65 cents when new. I saw an advertisement of one for $2.50. They said it was a new one and just too good for anything. I got one from the jeweler around the corner. They come all done up nice in a pasteboard box. I found this tag on the clock and showed it to the boys. I just wanted to let them see what they were up against when they tried to keep from coming in late."

Sammy read the small printing aloud:

"This clock is covered by the strongest basic United States patents and cannot be used until a sum of not less than $2.50 has been fully paid for it at retail. Any discount, rebate or bonus allowed on this price will annul the right of use and render the persons concerned in such transactions liable to suit for injunction and damages for infringement of the United States Letters Patent under which this clock is manufactured."

This notice was printed inside of a circle 1¼ inches diameter and occupied a vertical distance of 11/16 inch. It was followed by the name and address of a company.

"Well, men, what do you think about it?" asked Sammy.

"I think," said Joe, "that I'll buy a *clock* when *I* buy a clock."

Several of the men nodded their approval.

"As far as the customer goes, I think it is a bluff and a mighty foolish one at that. Why don't they put that in their ads. instead of putting it fine like that on a price tag. Suppose the jeweler didn't give you the tag, what then?" Mike shook his head belligerently.

"We told Ray," said Tom, "that he ought to have the jeweler make an affidavit, showing that he paid full price for it, and have it recorded at the county seat, and then send a copy of the records to the clock company. After that he would be safe in sleeping with the clock in the house."

Tom never neglected any of the details on a job put in his hands.

"Perhaps I am in for it anyhow," said Ray. "I didn't pay anything for the clock that I am now using. The one I got with this tag on it went bad in a few days, and I sent it back by one of the children. The jeweler sent me another, and it didn't have any tag on it. In this day and age when lawyers are allowed by the courts to split all sorts of fine hairs in suits, it might be wise for me to make the jeweler hand me over the money for the clock which I returned, and then take it again for this one. But, seriously now, Sammy, while I don't think for a minute that anyone who buys one of these clocks is in any danger of trouble, no matter what he pays for it, yet that printing must have been put on there for some reason. Regardless of what they *will* do, I would like to know what they *could* do under the law. A large percentage of the things we buy, which are not to eat, are patented. When a thing is sold in the open market by established stores, I have always supposed that I had a right to buy it without asking how the merchant bought it or whom he bought it from. I have known of a case where the owner of a patent advertised that fact and also made the claim that he was the sole maker and seller of the patented article. In such a case I can see that a user of an infringing article might be held to be liable, but this is the first time that I ever knew of a maker of an article holding the terrors of the law over the final buyer, that is to say, over the user of the article which has been openly sold in a store."

Sammy rubbed the bald spot on the top of his head while he thought the matter over. "I have understood that a man who made an article could bind his dealer to retail such article at a price which he, the maker, named, and that he could collect damages if the agreement were broken.

"When the owner of the store failed, the receiver did not pay any attention to such agreements, but sold such *contract* articles for what he could get, and I have never known of a sheriff paying any attention to them when selling for the benefit of a creditor. Perhaps the receiver and the sheriff did get into trouble, but I never heard of it. Under the rights of contract I suppose that a man could make a contract with another one, whereby the man buying an article would bind himself to sell it at a set price, but only on the condition that the next buyer would bind himself to sell at an agreed price, and to one who would make and pass along the same kind of an agreement. By such an arrangement it might be possible to make the buyer a party to the contract reaching back to the maker, even with several sales between them, but I have never heard of such a thing being done."

"If there is a law on the subject it would have to be a United States law and not a State law, to be binding all over the country, would it not?" asked Ray.

"It would seem so to me," said Sammy. "And it would also seem to me that there must be a contract between the maker and the buyer. I may be wrong about this, but it would certainly look on the face of it that when a maker sold an article, that sale carried with it the right for the buyer to use the article even though the article passed through the hands of a number of dealers in getting to the user. Even if the maker had a different contract with the middleman, the storekeeper, for instance, the buyer would not be bound by it unless he became a party to it, and this he could not do unless he knew about it. I would consider that the storekeeper was an agent for the maker in the transaction of selling, and not an agent of the buyer. The maker might possibly make the consumer or user liable by giving him notice of the contract with the middleman."

The last statement made Ray do some considering. "When a maker advertises an article in the public press, and names the price at which he sells it, is that notice enough? If it isn't, will it make me a law breaker for me to find a notice on the article when it is delivered to me after I have bought it and paid for it, the notice telling me I must not buy it and

use it except at a stated price, or more correctly, the notice does not forbid me to *buy* it, but does forbid me to *use* it? That notice is a notice after the sale. If that notice is legal is not the sale fraudulent?"

Sammy laughed as he answered: "I know more about machinery than I do about law, and I am even more ignorant concerning patent law than I am about the every-day kind, but in answer to your first question, I would say that the law assumes that we all of us know all of the law, yet I never heard it hinted that the law assumes that we read all of the advertisements of all the papers; therefore, I think that even if the notice were good if it reached us it would have to be proved that it did reach us. In answer to your second question; if the storekeeper acts as an agent of the maker of the article and sells it to you and gets the price he asks, he cannot hitch on additional conditions afterward. In answer to your third question I would say that, regardless of the strict construction of the law in such a case I should consider any dealer or maker who tried to deal that way as *crooked*, to say the least."

"Somebody, a lawyer likely, says, 'a man who is his own lawyer has a fool for a client,'" said Ray. "But I read in a book called 'Every Man His Own Lawyer' that a bargain is made when the minds of the parties agree. My mind only agreed to buy an alarm clock in this case. It brings up a whole lot of ideas to think of the way business could be tied up if such a thing as this will hold water. It won't just do to say they could do a lot of things but they won't. Some day some fellow will, if he knows that he can, and then what? You have been running a shop for years. Where are you when it comes to repairing patented machinery?"

"That is a matter that we haven't time to go into today. There goes one o'clock. Time to go to work." Sammy knew that work time was money, and did not like to have it wasted. "I know a place that is chock full of information. A good many of you fellows read the AMERICAN MACHINIST; you all ought to. I'll have a friend write to them, and if the editors don't know all about it they know somebody that does. Just watch and see."

The men seemed satisfied for the time being.

"Hey, Ray, wouldn't it be awful if that new patent lathe that is coming had a plate on it saying 'dudes must not be allowed to run this lathe?'" sung out Bub, the shop boy, as he dodged behind Mike before Ray's foot could reach him.

The subject is one that is of interest to every owner of a patent and to every user of a patented article, for there are many patented machines in use today of which not a single piece of the original machine remains, replacements of worn or broken parts having been made by the repair gang.

Efficiency in Teaching Shop Work

By C. A. HOEFER

That many, yes nearly all the manual training, technical high schools, trade schools and engineering departments of universities have failed to grasp the points of efficiency as pointed out by L. J. Rodgers in his "Efficiency of Shop Training in Schools" is patent, as a result of which failure manufacturers do appreciate the work of the practical training rather than the parade of school training as it is now offered in many of the schools. Very few people care much for the sheepskin, inasmuch as the final test must in any case be "What can you do?"

Every manufacturer appreciates the appeal of Mr. Rodgers who has, no doubt, seen the fallacy of some of the training now presented, and his suggested change, in that it should produce men, thorough machinists as far as they go, will be heartily welcomed.

With our increasingly intensive manufacturing methods in which we can take a young man, oftentimes without any previous practical experience but with the guidance of a practical man sometimes referred to as the "buster," and make of him an expert operator on a special machine, where we can afford to pay good wages, it will become increasingly difficult to induce young men to enter apprenticeships which consume from three to four years' time at comparatively low wages. This phase of the matter brings before the manufacturer the problem of filling those places in his shops where skilled men are required. In their present state, many of the trades and similar schools will not give him (the manufacturer) the foundational man he requires, and it is then for him either to help the present schools to a better understanding and significance of their position or to urge the newer methods.

INSTRUCTION SHOULD BE PRACTICAL

The great weakness in many cases of the present machine-shop practice is that the men directing the work are themselves too far removed from the actual practice of things. I recall to mind the conditions of ten years ago in the machine shop of one of our foremost engineering schools, famous not only in America but abroad for the men it has turned out. These men would have made a name for themselves under almost any circumstances, for I firmly believe that it always depends on the man, and not on whether or not he has had a college education.

The head of the department, called the professor of machine-shop practice, was a man who had been removed from actual practice for some fifteen or twenty years, and naturally, shop methods were antiquated, as were likewise the methods of his assistants. Not a few of the students had previously had limited shop experience and naturally, when they came into the shop to do the little exercises set for them, which were graded and then scrapped to be melted over by the foundry department, there was little incentive to any of the principles which make for success in any manufacturing plant.

I contend that if schools are to give these men ideas of machine-shop practice, it should be of the best and latest. This does not necessarily mean the throwing out of all old equipment, and buying every new machine tool as fast as it appears in the "Shop Equipment News" section; but it does mean the adoption of the more recent methods of shop practice, and the coöperation of manufacturers and school during the summer months.

I have had in my employ quite a few college men during the vacation periods of their college years, and I find them willing to pick up modern machine-shop methods, but the foundations laid have been too often antiquated. Let the men in charge keep abreast the times and give their students something which will stimulate them in the performance of their work. Then the complaint of graduates being anxious to hide their diplomas and evidences of school training from the manufacturers will have disappeared.

In any event, I think the problem finally does simmer down to that of "the man."

Kinks for the Blueprinting Room

By J. J. O'BRIEN

To test a print in the frame, blow the breath on the corner of the border line. If the line perceptibly darkens, the print is done.

Simple washing in water will make a good print if the paper is not aged. Ordinary commercial blueprint paper for sunlight exposure will keep from 4 to 6 weeks in a metal tube before commencing to deteriorate. However, if the paper is aged, or the print slightly overexposed, the lines will appear pale blue and the background fairly dark after washing.

To make a good print with such paper, add enough of a previously prepared saturated solution of potassium bichromate to make the bath a pale amber color. The effect of adding the solution is to intensify the background and bleach the lines, making a sharp contrasty print. It is not a bad plan to subject every print to a slight overexposure and use the bichromate solution habitually.

For a pale print practically nothing can be done except to wash quickly, about ½ minute, as the water bath has a bleaching effect. Drying in a darkened room will prevent further bleaching.

Silverware Factory Methods

By Ethan Viall*

In a previous article we described the process of making a loving-cup handle and a large berry bowl, as done in the factory of the Mauser Manufacturing Company, Mt. Vernon, N. Y., while in this article we will first describe the making of an ordinary silver table fork, and then briefly touch upon some of the more general methods and processes used in that factory.

Evolution of a silver table fork. Sawing out the tines and removing the flash.

How silver dust and scrap are saved.

Using the jig saw on openwork patterns. Putting ivory in silver handles to prevent heating. How deposited work is produced.

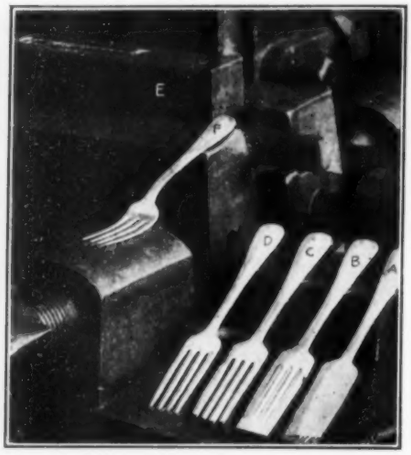

FIG. 1. A SILVER TABLE FORK IN ITS VARIOUS STAGES OF EVOLUTION

*Associate editor.

MAKING SILVER FORKS

In Fig. 1 are illustrated the various steps through which a silver fork passes in the press room, *A* being the fork just as it is blanked out from the original rolled sheet, while *B* shows the fork after the first impression given it in the drop-hammer die. The fork is then taken to a small saw and the metal sawed out between the teeth, leaving it as shown at *C*. The fork is again placed in the die and the drop allowed to fall on it, leaving it as shown at *D*, the die in which the forming or shaping is done being shown at *E*. A formed fork, bent into shape in which it is used is shown at *F*, the forming or bending being done in another die not shown.

The saw used to saw the metal out between the tines of the fork is shown in Fig. 2, while the outside fins or flashes left by the die are taken off by using the rotary file shown in Fig. 3, which takes the metal off without mixing any refractory substance with it, which would be the case were an emery wheel used, and which would be apt to give trouble in the subsequent melting of the scrap silver.

Both the saw and the rotary file are inclosed in a case with a glass top, as shown in Fig. 4, which is done for the purpose of preventing loss of silver during the sawing and trimming process, as well as for the protection of the workmen's eyes.

After leaving the press room the forks are taken to the bobbing or rough-polishing department, which is illustrated in Fig. 5, where the forks are first rough polished and are then passed down the line

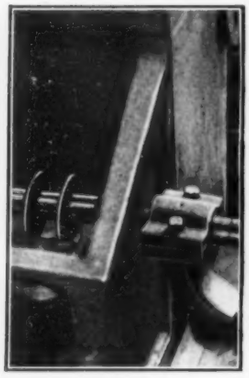

FIG. 2. SAWING BETWEEN FORK TINES

FIG. 3. ROTARY FILE

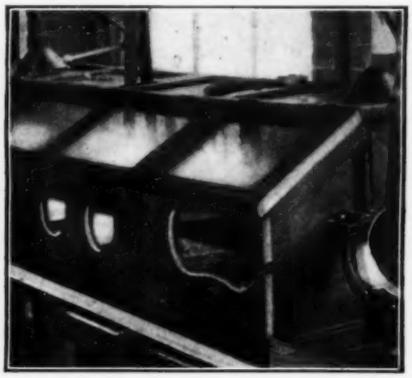

FIG. 4. GLASS-COVERED BOX FOR SAWS AND ROTARY FILES

FIG. 5. BOBBING AND FINISH-POLISHING DEPARTMENT

FIG. 6. ROLLS USED TO PULVERIZE ASHES AND DIRT CONTAINING SILVER

FIG. 7. JIG SAW USED TO TRIM OR SAW OUT SILVER STAMPINGS

FIG. 8. HORIZONTAL GRINDING WHEEL FOR SMOOTHING PARTS TO BE FITTED TOGETHER

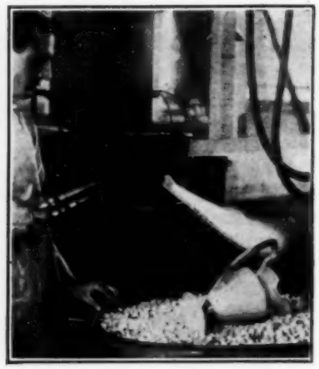

FIG. 9. BRAZING THE HANDLE ONTO A SILVER PITCHER

until they are at last given their final finishing.

Saving Silver Dust and Scrap

It will be observed that while the guards and pipes over the polishing wheels protect the operator from the dust, they also prevent waste of the silver taken off in the polishing process. In every operation throughout the entire factory the greatest care is taken to save the silver that would be wasted if not carefully collected. Sweepings, dirt and even paper are carefully collected and burned in a furnace, the ashes being saved and rolled or pulverized in the pulverizing mill, shown in Fig. 6, after which the ashes or resulting dirt is carefully placed in barrels which, when full, weigh about 400 pounds. At the end of each six months the dirt and ashes that have been collected during that period are sent to the refiner, usually resulting in a saving of thousands of dollars worth of silver for each period.

Pressed silver work of an open pattern, is first marked in dies or by hand, and then sawed out in a saw resembling an ordinary jig saw, which is shown in Fig. 7. These saws are also used to trim off the extra sheet silver left around the loving-cup handles described in our previous article.

Knife handles made in halves, and other work requiring to be fitted together, or that requires a flat surface, are smoothed off on the horizontal wheel, shown in Fig. 8. These knife handles, or other parts which must be soldered or brazed, are then taken to the silversmithing department and brazed together; the brazing of a pitcher handle being shown in Fig. 9. In placing silver handles upon silver vessels, such as teapots, a small piece of ivory is placed in the ends of the handle next to the body of the silver vessel, and the handle is then brazed into place. These small pieces of ivory retard the heat traveling from the vessel to the handle and keep the silver handle comparatively cool when the vessel is filled with hot liquid.

Fig. 10. Hammering Up a Silver Platter

Fig. 11. Swaging the Rim

Fig. 12. Flattening the Bottom

Fig. 13. Engraving an Open-work Tray

Fig. 14. Chasing with a Hammer and Punches

Fig. 15. Painting the Pattern for a Silver Deposit

Fig. 16. A Few Examples of Silver-deposited Work

Shaping a Platter

Large platters are formed by hand from a sheet of silver, which has been cut out into a circular form, and are then hammered roughly into shape, as shown in Fig. 10. The platter is next placed under a special swaging hammer, shown in Fig. 11, and the form of the edge smoothed up, after which the bottom is hammered flat in the special hammer shown in Fig. 12.

The use of a hammer such as shown, prevents the back kick that is so common

in a hammer wielded entirely by hand, the straightening of the bottom of a platter like this being very similar to the hammering and straightening of a circular saw, with which many of our readers are familiar.

The models for the plaster of paris patterns for cast-iron dies, described in our previous article, are made by hand in a manner very similar to the hammering up of this platter, a process which will be readily understood by those who have read the previous article.

Much of the work on fancy platters, trays or other pieces, which cannot be done by machinery, must be hand engraved, as shown in Fig. 13.

The work on silver products known as chasing, is done by first filling the article with pitch, in order to hold it properly and give it a backing, and it is then mounted, as shown in Fig. 14, and the chasing done with small punches and a hammer, as illustrated.

Depositing Silver on Glass

What is known as deposited work, which consists of a network of silver formed over glass or some similar material, is produced by first painting the glassware with a special paint, which will take electro deposits, and then placing the glass so treated in a plating bath. In Fig, 15 is shown a bottle in the process of painting, the bottle being placed upon a small table, which may be rotated, and the girl rapidly sketches the design upon the bottle with a small brush, rotating the table as necessary with the left hand. The outline for the pattern is originally placed upon the bottle by wrapping an open-work paper pattern around the bottle by sprinkling with talcum powder, after which the pattern is removed and the painting done with the powder marks as a guide. As soon as the painting is completed, the glass is taken to an oven and paint thoroughly baked, after which it is taken to the plating bath and a heavy deposit of silver given it; the silver, of course, only adhering where the paint has been placed upon the glass. This deposit is then polished.

A group of glass vessels upon which silver has been deposited is shown in Fig. 16, and fully illustrates the beautiful effect of the depositing process.

Intensive Production and the Foreman

By A. Hamilton Church

Systematizers are apt to ignore the shop foreman in working out their plans. His position in the new order of things—intensive production—has never been accurately pointed out. Mr. Church shows that he should not be a specialist but a man with a wide view of all the conditions in his department and constantly watching the broad results.

A practical question that has hitherto escaped adequate discussion; namely, the relation of the ordinary foreman to the new methods of securing increased output, or "intensive production," has been raised in a previous article and deserves attention.

In certain quarters there is a tendency to systematize the foreman out of existence altogether. This is most popular with the "root and branch" reformers who insist that efficiency can only be reached by yielding control of a plant for an indefinite period to experts trained in a particular school. Personally I must confess to a certain amount of skepticism as to the necessity for such autocratic introduction of reforms, and still greater skepticism as to the permanence of the efficiency obtained in that way. But as very few owners will be found who do not prefer to trust to evolutionary rather than revolutionary methods, I shall deal here only with the question of plants that are feeling their way toward efficiency by healthy and gradual progress.

It will, therefore, not be necessary to discuss whether "functional" foremanship may under special circumstances and in the distant future, wholly replace the foreman as we know him now, but simply the more practical question as to what place in the gradual introduction of scientific methods the existing type of foreman is to occupy.

Under the older régime the foreman was one of the pivotal functionaries, filling an analogous position to that of Kipling's "noncommissioned man — the backbone of the army." In him was vested great authority, he acted as a "buffer state" between the executive and the operative force, he was the recognized court of appeal on all "practical" matters; he was the repository of a vast body of technical wisdom; he devised ways and means of handling unfamiliar work; he was responsible for discipline, time-keeping, quantity and quality of the output of his men—in short, it is very difficult to say what was or was not within the sphere of a strong and competent foreman of 20 years ago.

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At the present day a foreman's job may vary in importance from nearly all the above down to that of closely limited powers more like a "leading hand," save that he may be placed over a large shop with several leading hands under him.

It is evident, not only that the position of the foreman has been passing through many changes, but that it is time that some serious consideration should be given to the status of so important an official, under the modern method of planning out, forecasting results and determining efficiency by comparison of "results actual" with "results expected." In justice to many most harrassed members of the craft something ought to be done to define his sphere, preserve his usefulness and protect him from the inroads of reformers who have only a vague idea of what he is there for. Also, if this question can be adjusted even approximately many forceful and aspiring men will set themselves to acquire whatever new qualifications may be wanted, instead of regarding the new principles of management with silent hostility and uneasiness.

The abolition of the foreman may be briefly considered—and dismissed. There is nothing fundamentally *impossible* in doing this. It is obviously a matter of subdividing his remaining duties among others, as many of his old-time duties have been assigned to others. In some "factory" types of undertaking each foreman's responsibility is exceedingly limited, but in proportion as the product is less uniform he tends to assume greater importance. The reason is that the purely factory type of organization is absolutely rigid; it does not require, and could not effect if it did any modification of its daily round. Now, in spite of the trend toward standardization and specialization, the ordinary machine shop will never arrive at that condition of rigidity. Consequently, it would seem that too centralized and rigid an organization may have dangers. The whole idea of having a foreman is a delegation of control for certain purposes. Chief among those purposes is the maintenance of a certain *elasticity*, which will take up lost motion and *compensate for the machine-like character of even the best organization by subdividing the general supervision into sections small enough for all the current events in each of them to be grasped by the foreman concerned.*

What Is a Foreman?

This consideration helps us to a definition of what a foreman is. He represents the last outpost of general control

as distinguished from special control. In other words, the function of the foreman which must survive all others is the administrative function. His special knowledge is to some extent superseded, but not wholly, as we shall have occasion to observe presently. But within his department he is or should be the man to see that all the various functions now performed by other members of the organization are effectively performed. Briefly, and in old-fashioned language, he represents "the master's eye" in the department over which he is set.

Considerable support to this view of the foreman's functions may be found in an extract from a paper read before the American Society of Mechanical Engineers by John Calder, manager of the Remington Typewriter plant at Ilion, N. Y. Though the type of work referred to in this paper is an unusually complete example of factory or mass production . . . . . being wholly confined to the making and assembling of an immense variety of interchangeable parts Mr. Calder, while fully alive to the importance of routing, instruction cards and so forth, seems to think that the shop foreman's day is not yet done. "The writer," he says, "does not favor the restriction of the ordinary shop foreman to productive supervision, but prefers to encourage them to compete freely with the time study staff for the best results. If pains are taken to give publicity to all good suggestions adopted from foremen, a surprising amount of very profitable cooperation can be obtained from them, which enhances instead of diminishes their administrative ability."

The Foreman's Qualifications Will Tend to Rise

These remarks of an advanced and progressive manager go far to indorse my own view, namely, that so far from the introduction of scientific methods tending to improve the foreman out of existence, his qualifications, on the contrary, will tend to rise, notwithstanding that his active duties are less extensive and less varied. It may be that he will have to direct less and to observe more. If planning out, rate-fixing and similar specialized functions are taken from him and committed to special persons or departments he must still remain the active observer and intelligent critic of their operations. If exact records of each man's performance are a matter of routine quite apart from his personal observation, his personal relations with his men must always remain an important factor. *Surrounded by specialists and making use of the material they prepare, it must be the particular value of the foreman that he is not a specialist but is capable of looking at the whole life of his shop with a well balanced eye.*

Obviously, to perform this function successfully, the foreman must make himself acquainted with the routine of the specialized departments, to know how and when he may use individual discretion without throwing the machinery out of gear. In an emergency he must know just what to do, not only in regard to the work but also in regard to the specialized departments. Just how to accommodate the exercise of discretion by the foreman without disturbance of routine is a fine problem which requires very careful consideration at the hands of reformers. Hitherto the tendency has appeared to be a conjugation in the imperative mood—"thou shalt not interfere." Very convenient for the systematizer, but not quite, I venture to think, a final or satisfactory solution of the question.

The "Line and Staff" Plan

Among the valuable generalizations that have helped to develop the manufacturing problem, that of Harrington Emerson, borrowed from military organization, is one of the most illuminative; namely, "line and staff." It should be noted in this connection that the development of staff services in military affairs has not rendered less important the work of the company officer and the sergeant. In the same way, properly balanced, the development of specialized staff services in the machine shop should not diminish the value of the company officers and sergeants; that is, the departmental officials in charge of the practical affairs of the shop. The object of staff service is to serve. It cannot be at the same time a successful executive, or at least such a state of things would be contrary to all experience and, though it might work for a time, it would obviously be liable to break down very hopelessly if anything happened to derange the exact routine it follows. It appears to me that good foremanship is intended to obviate just this danger.

Is Planning and Operating a Function of Foremanship?

Some of the questions raised in connection with this phase of foremanship must, I think, be answered in the negative. Some writers call for the planning and operation departments being made a subdepartment of foremanship. There are several reasons why this cannot well be done. In the first place such departments, if properly organized, have a different viewpoint from that of any single foreman. They take, or should take, not the shop but the factory as the productive unit. They should be in close touch with the designing departments. They have to arrange for coöperation, or, as it is better called, coördination of the work of every executive officer in the plant for every single job. Such work could not be scattered here and there without loss of efficiency.

But there is a still more weighty reason why they must work independently of the foreman, though in collaboration with him. Under the definition of his work arrived at above the foreman represents the "master's eye." He has to see that his men do the work in the way approved by the specialized departments, but in addition to this he has to watch the broad results attained. He must not groan in spirit if some little thing is done in one way, when he thinks it should have been done in another. He must think in averages not in particulars. If he sees instances of inefficiency he must note them and place them alongside instances of efficiency. If he is sure that the balance when struck is unfavorable then he must speak up, not in a captious spirit and in a "I-could-have-done-it-much-better myself" strain, but with a view to helping the executive to strengthen the weak element and bring it up to full working strength.

The Broad View To Be Taken

It is, no doubt, true that both the foreman and his employer have to shift round to a new viewpoint of his duties under modern methods of shop administration. A little friction in settling on this new viewpoint is perhaps unavoidable, but that is all the more reason why the subject should be thoroughly discussed. When things have settled down, it is probable that the foreman will have no reason to be dissatisfied with the change. Of course, I am speaking of foremen as a body, and especially of the many members of that body who are progressive men and only too willing to help along any methods that promise greater efficiency. For every advance in efficiency, every lowering of cost, widens the area of the engineer's operations, brings more work of a remunerative character to the machine shops of this country and provides greater future rewards for every kind of skill and experience in manufacturing.

Rewinding a Spring

By J. E. Job

The only wire of the correct size in the shop had already been wound into a right-hand spring and a left-hand coiled spring was required for a special purpose.

I put the mandrel for the left-hand spring between centers and a mandrel fitting the right-hand spring, which had already been wound, in the tool-post parallel with the lathe centers.

The end of the right-hand spring was put in the hole in the mandrel for the left-hand spring and the lathe started. The spring unwound from the mandrel in the tool post and wound on the mandrel between centers with entirely satisfactory results.

Methods of a Western Railroad Shop

By M. E. Hoag

Protecting men against gears, belts and universal joints. Special tools for turning driving-box brasses and eccentric straps.

The Chicago, Burlington & Quincy Railroad shops at Burlington, Ia., are old, having been built a number of years ago, so that the task of bringing them up to modern practice has been a hard one, but this has been very successfully worked out by Superintendent of Shops Carney and his assistants.

A feature of special interest was the evident care shown in the application of devices to safeguard the employees from accidents. These devices were applied not only to open gearing, but also to belts and pulleys, and even to the counterweights on boring mills.

The protection on lathes and other machines having open gearing, consisted of cages made from heavy galvanized wire screen of about ½ inch mesh, strengthened and supported by steel straps; and with hinges and locks, or other simple means for gaining access to the working parts. These devices presented not only a neat appearance, but also kept the working parts in sight, a feature much to be desired, especially on lathes where change of gearing is often necessary. The workman is able to see at a glance what gears are on without removing or opening the device.

The protections for belts and pulleys, such as planer drives, were made of gas pipe, and built in such a simple manner that, like the other devices, they gave ample protection without in any way interfering with the working of or free access to the parts.

These devices were in no way expensive, the initial cost in any case would be easily offset by the time lost, and the hospital bills for even a slight injury. One of these many safety devices is shown in Fig. 1 as applied to the knuckle joints on a Brown & Sharpe milling machine.

Machining Eccentrics

The halftone, Fig. 2, shows a turret-tool head *A* in use on a vertical boring mill

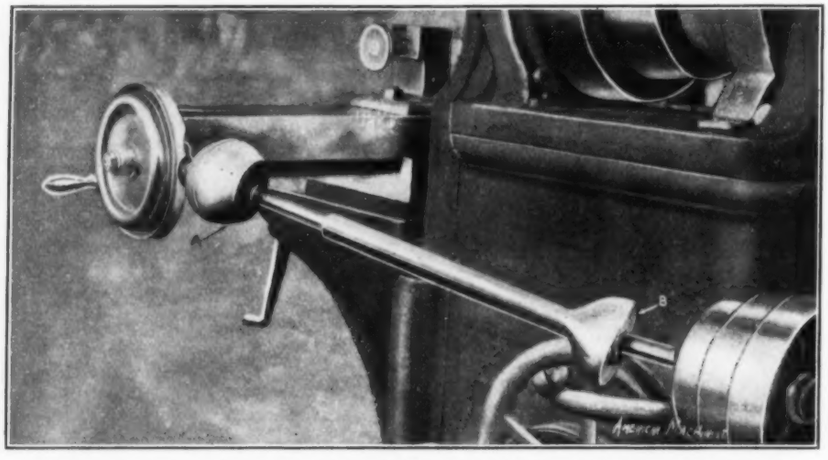


Fig. 1. Safety Device Applied to Knuckle Joint of Milling Machine

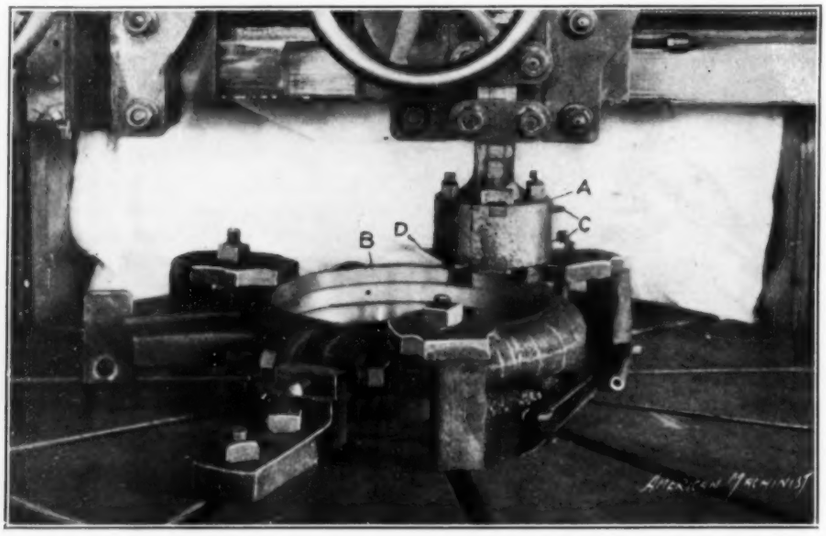


Fig. 2. Turret Tools for Eccentric Straps

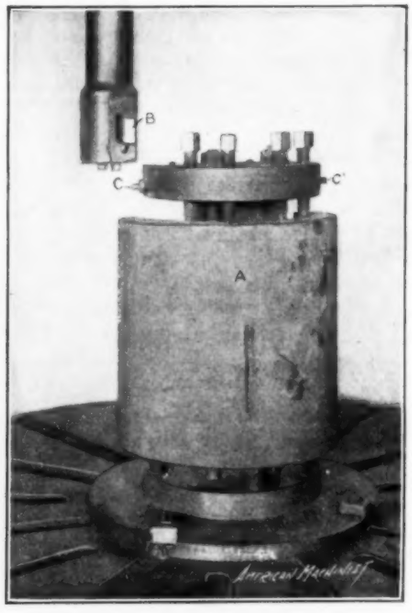


Fig. 3. Machining Driving-box Brasses

Fig. 4. Illustrations of Pack-hardened Bushings

for machining eccentric straps. The strap shown at *B*, however, is smaller than the ones for which this tool was designed. The strap is first bored, then the two tools *C* are brought into use and turn grooves for the recess, after which it is bored out with the tool *D*. This tool was designed by Mr. Howard, the operator of the boring mill.

Machining Driver Brasses

Fig. 3 shows a rather unusual method of machining driver-box brasses on a slotter instead of turning in a lathe as is the usual practice.

The casting is located on the fixture and held by set screws as shown. The stops *C* and *C'* are adjustable by a nurled screw, not shown, operate together, and are concentric, so that the necessary measurement is taken from the box, the stops set to correspond, and the tool *B* set to one of them, allowing for a finish cut. After finishing the outside radius and at the same setting, the dovetails are cut, which insures a perfect fit between the box and brass.

Another item of note in these shops, is the use of pack-hardened bushings in holes that are subjected to great wear. Two cases as illustrations are shown at *A* and *B*, Fig. 4. This simple practice is a matter of great economy, for a new bushing makes a valuable casting or forging as good as new, and that, with a very small cost for labor and material. These bushings are made for less than the cost of seamless steel tubing.

A Broad View of Profitable Ethics

By David Van Alstyne *

Extracts from a paper before the Congress of Technology in Boston, showing an unusual view from the standpoint of an employer.

*Vice-president, Allis-Chalmers Company, Milwaukee, Wis.

Business is war and money-making is and always has been the chief motive of all our efforts at progress. In the present organization of society it is inevitable that money-getting shall be primarily our inspiration, and indeed, it is doubtful if any other motive will ever be practicable. On the other hand, unrestricted money-making, like any other dissipation overdone, is not good for the health of the body politic.

The chief manifestation of the disease is in the extremes of wealth and poverty, the former of which is unnecessary and the latter ethically and therefore morally wrong. Because poverty is wrong it will not be permitted to continue always.

Maximum output, lowest cost of production and highest wages can be accomplished through the accurate knowledge of what every detail of the business actually is, the determination of what it should be and the bringing of the actual to the standard and keeping it there.

Every man is capable of a reasonable maximum output, every dollar spent is capable of a maximum return and when the maximum results are reached, the efficiency is 100 per cent. The higher the efficiency, the lower the unit cost and the higher wages the employer can afford to pay as compared with competitors.

Few men in positions of great executive responsibility realize how little influence they exert on the business under them. It is not a serious exaggeration to say that the difference between the results obtained by an average manager and one who is known as an exceptionally able man is not material, and whether the result is good or bad is largely accidental in so far as the man in charge is concerned, and chiefly due to conditions surrounding the business.

Restriction of output (which is not the policy of organized labor but is their tendency), opposition to piecework and premium or bonus systems of paying for labor, limitation of the number of apprentices are not economically correct, and nobody realizes it more than the more intelligent Union man; but they constitute correct policy from the Union point of view because they are among the few weapons labor has with which to fight and defend itself against aggressive employers.

Under usual conditions they are necessary to the existence of organized labor. So long as employers consider it necessary to oppose organized labor, just so long these weapons will be used, to the detriment of the employer. If, on the other hand, it should be considered safe to work with organized labor, they soon get the employer's point of view and he theirs. Each sees that the other is right and they adjust their differences by making an agreement. Mr. Gompers rightly says that it is necessary for labor to deal collectively with employers on account of the great difficulty the individual has in getting the attention of those highest in authority in large concerns.

Individual records enable the workman to know that his employer knows beyond question that he is as good or better than his fellows. Moreover his employer has a feeling of security in that he is able to deal justly with each individual through his records rather than through the more or less prejudiced opinions of subordinate officials.

Not the least asset created by the management which has accurate record of the individual, is the impression made upon the employee that the highest officials know of him personally; that he is less subject to the whims and prejudices of his immediate superior and that he is recognized as an essential part of the organization, which arouses an enthusiasm that cannot be too highly valued.

The treatment of men like machines by dealing with them as a class and treating good and bad more or less alike, creates indifference and antagonism, and is the necessary result with conventional management.

It is not sufficient to know that high-speed steel *can* cut four times as fast as carbon steel or that one make of file *is* seven times as good as another. It is of much greater importance to know that high-speed steel *does* cut four times as fast as carbon steel and that the good file *does* all that it is capable of, and that they continue to do so as long as they are used.

The Cause of Scarcity of Skilled Labor

The chief cause of the scarcity of skilled labor is the extreme fluctuations in business, creating at one time an abnormal demand and at another throwing both skilled and unskilled labor out of work.

There are more skilled men and there is skill of a higher order than ever before; but by the nature of things their number is more or less adjusted to the average demand. There is always available a nucleus of these good men who have comparatively steady work and during times of extreme activity, the only men available are those who spend a considerable portion of their time in idleness. In times of great activity there is no good opportunity to train this generally unemployed increment and in dull times idleness encourages laziness, indifference and a loss of the little skill men acquire while at work. We are inconsistent in throwing as many men as possible out of work as soon as business begins to decline and then complaining that they are not capable of the highest efficiency when they are employed.

In my opinion this is the greatest evil for which our present social system is responsible and it is also the most difficult to regulate. Apprenticeship, trade schools and like efforts to train skilled workmen, are all good to a certain degree, but their influence is insignificant as com-

pared with the influence of long periods of enforced idleness to which the laboring class is subjected.

It is important to develop skilled workmen, but it is of much greater importance to develop loyal American citizens who are interested in promoting the welfare of the State and consequently that of the employer. It is out of such employees that the employer makes the greatest profits in the end.

Dangers in Idleness

There is not much encouragement for a man who spends a considerable portion of his time in idleness to become either the right kind of citizen or employee.

This ever-present fear of being thrown out of work makes men hold back their output in order to make the work last as long as possible Aside from the inhumanity of periodically depriving a considerable percentage of our citizens of the means of earning a living, it would seem good business policy in the long run for employers to find some way to keep a large percentage of their employees on the pay roll at at least a living wage during periods of dull business, whether there is work for them or not; and it is probable that a great deal more could be done in this direction than is done.

It is to be hoped that some day it may be found practicable for the law to require employers to take care of a certain portion of their idle employees during periods of depression, and the Government to give employment to the rest on public improvements.

It is encouraging to note the number of concerns which are introducing old age pensions, profit sharing, etc. It is to the pecuniary interest of the employers to do these things themselves rather than to wait for them to be done by the Government with its inevitable inefficiency.

The Personal Relation

Every large employer of labor can afford to have what might be called a "sociological department," whose duty it would be to look to the welfare of its employees, so long as it is not done in a patronizing manner. Such a department should keep a personal record of each employee, consisting of whatever information of value is obtainable; to be used in deciding as to desirability as an employee, eligibility for promotion, instead of depending on haphazard opinions which are usually superficial and biased.

It would also keep as closely in touch as possible with employees to find out what secret grievances they are brooding over, due to brutal, prejudiced and partial treatment by superiors; and be ready to lend a helping hand in case of misfortune, sickness or death. Apprenticeship, pensions, profit sharing, prevention of accidents and hospital service might also properly come within the jurisdiction of this department.

Having in mind that the large employer will not attain highest efficiency which will continue indefinitely until he produces, as closely as possible, the personal relationship between superior and subordinate which exists in the case of small employers, it would seem that the best way to accomplish it is through a department created for the purpose.

This department would, in the long run, be one of the most effective in increasing net earnings.

The Evils of Speculation

The speculative financial influence is a serious obstacle to the progress of better management, and, in consequence, to its own interests. Not only does it not understand the human element in its business, which is the important element with a large employer of labor; but being in control, it usually dictates a narrow, opportunist sort of policy based on superficial opinion rather than scientific investigation. It cannot see that a moderate investment in better organization and management will, in nine cases out of ten, save a large investment in equipment, besides reducing the cost of the operation.

Little improvement can be expected until the average board of directors takes more interest in the business it directs and becomes more intimately acquainted with the details. It would seem that one way to accomplish this would be to have each department head report direct to the board instead of through the president, who as a rule is a specialist in only one department. It would also seem advisable for the board to have specialists report on the efficient operation of all departments in a similar manner as chartered accountants report on the accounting department.

Educating the Owners

It is strange but true that it should be difficult to persuade the owners of a property to accept greater profits with small investment. It is equally true that the scientific manager will find it more difficult to educate his superiors than his inferiors.

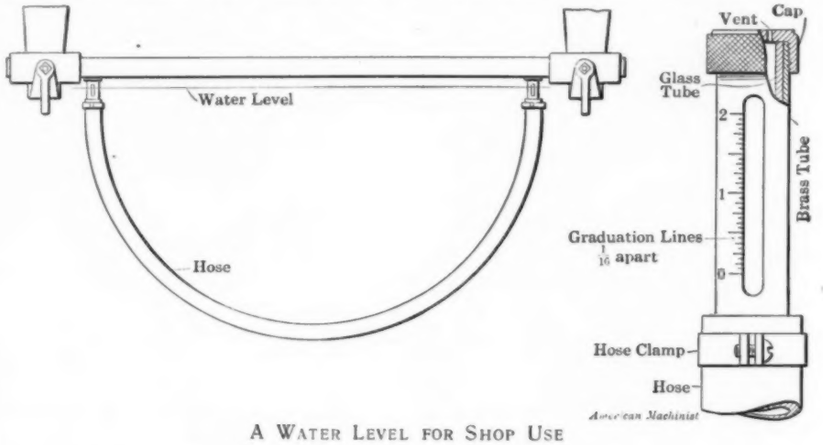
Is it not safe to conclude that these employers who have had the experience and the profit will be convinced that the most ethically conducted business is the most profitable; that business ideals must be ethical ideals? Will it not be a definite and concrete way of getting into practical use those theoretical ideals so attentively listened to on Sundays but so regularly forgotten on week days?

Would it not hasten the Utopian condition which all right-minded men believe in and hope for; namely, that every man who is willing to work is entitled to a living and that no man is entitled to so much that somebody else must go hungry?

A Water Level for Shop Use

By M. R. Wright

The cut shows an instrument I use for leveling countershafts and lineshafts. This leveling instrument consists mainly of a piece of hose of suitable length. In each end of this hose is fastened a brass tube with a thread on its outer end for a cap. There are two slots milled in each tube and along the side of the slots are graduations. Inside of this brass tube is a glass tube. Care must be taken to have the distance from the upper graduation line to the top of the cap exactly the same on both ends and each cap should have a small vent hole in it.



A Water Level for Shop Use

Before this instrument is ready for use it will first be necessary to unscrew the caps and to fill the hose with water. The edge of the water should come about half way up in the glass tubes. After the caps are screwed on again the level is ready for business. I always hold the level close to the hangers as shown and if the distance between the hangers is too far for one man to reach I have the helper hold up one end of the level and read the gage. When the water level is on the same division line on both ends the alinement is perfect.

Press Tools for Dome Pot Covers

By M. Martin

An interesting set of dies for making four "dome" covers at a time in one operation; how the tools act upon the sheet metal to give the desired results without wrinkling the surface of the material.

The following description, with the sketches, explains a practical and new way of making "dome" pot covers in one operation, four at a time, without a wrinkle, and with edge reversed or turned down to fit the pot, in what may be called a "double-action-combination-die," for use in the double-action press.

Usually to make a cover having a shape similar to Fig. 1, the dome part is drawn as near the shape as possible, which is likely to produce wrinkles all around the "swell" as indicated, and then stamp the work in another operation to knock down the edge, and incidentally smooth out the wrinkles formed in drawing. By the use of a die constructed as outlined below, the covers are ejected from the die without a wrinkle anywhere, and the edge reversed all ready to be trimmed and beaded to finish.

Fig. 1 is the dome pot cover as it comes from the die after being drawn up four at a time without a wrinkle anywhere. The variation in size between the first and fourth shell is immaterial in this instance, as the cover has ample room to fit "sloppy" on the pots intended for.

Fig. 2 shows the mechanical appearance of the shell drawn by the method in Fig. 8, which will be more fully explained, and which prevents the formation of wrinkles around the swell.

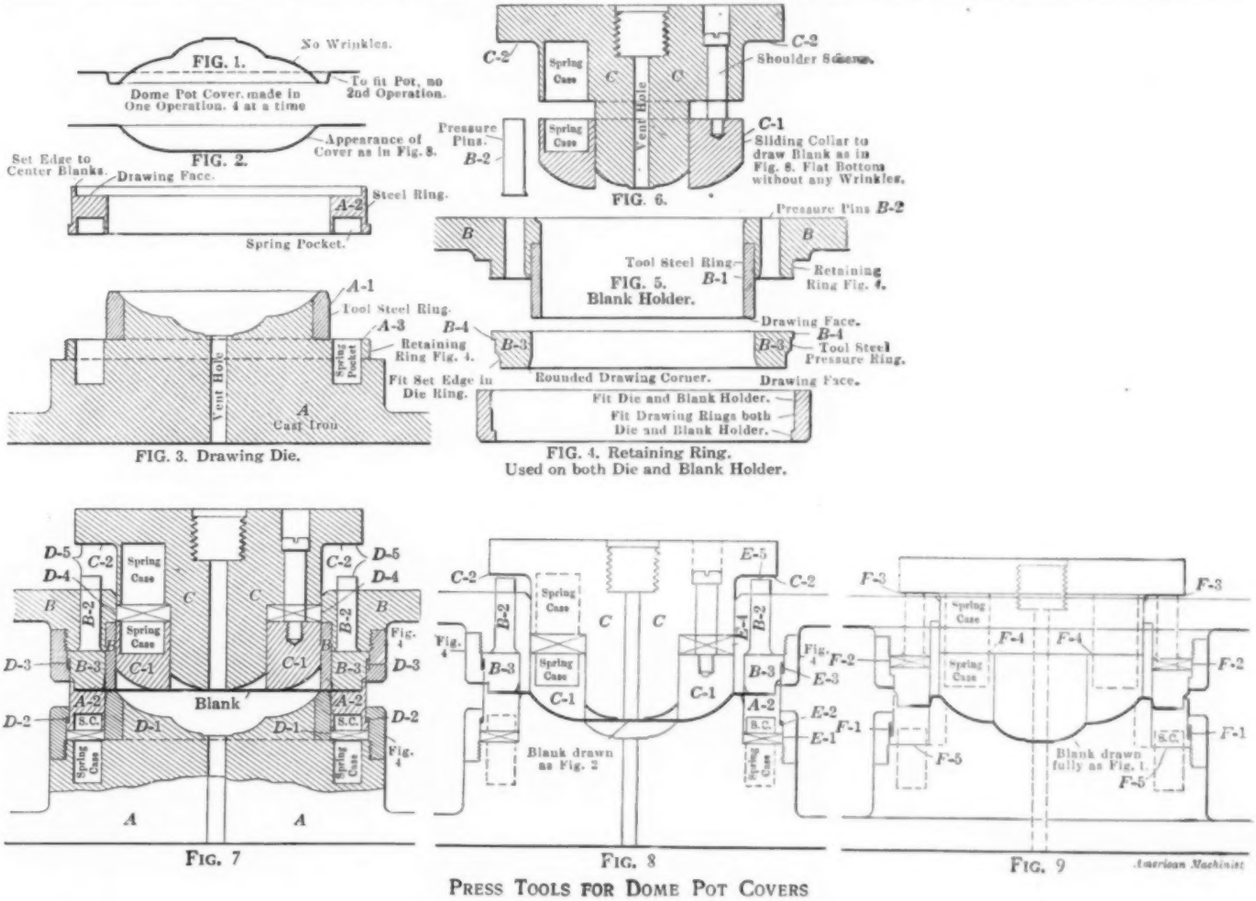
Details of the Die

Fig. 3 is a detailed sketch of the die itself. *A* is a cast-iron bolster having a tool steel ring *A* 1 fitted around the working points to withstand the pressure and the strain in drawing. It has the form of the cover worked out, the top corners both inside and outside being rounded for the easy working of the metal; it is threaded on the outside for the retaining ring, Fig. 4, and has a seat *A* 3 which takes the thrust of ring *A* 2 in reversing the flange or putting on the shoulder of the cover. The bolster has numerous pockets to hold and support heavy spiral compression springs that in turn support the tool-steel ring *A* 2, which ring is also recessed or cupped to hold these compression springs in place. *A* 2 is the die drawing ring made of tool steel which is machined as in the sketch, and has a set edge turned in the drawing face to center the blanks and the blank holder. The compression springs force this ring up against the shoulder of the retaining ring, Fig. 4. This die is supplied with a vent hole through the center to allow the air to escape as the blanks are formed, which is very important.

Retaining Rings, and Blank Holder

Fig. 4 represents the retaining rings, one for the die and one for the blank holder, which prevent the rings on both from either falling or being forced off. These rings being screwed on facilitate the removal of all parts in case of accident.

Fig. 5 is the regular double-action blank holder supplied with a sliding ring and pressure pins in regular combination-die fashion. *B* is a cast-iron bolster with



PRESS TOOLS FOR DOME POT COVERS

tool-steel ring *B* 1 inserted to withstand the pressure of the double-action press toggles or cam, and it has eight pressure pins, *B* 2 all of equal length, as in the sketch. *B* 3 is also of tool steel and slides over *B* 1. It is actuated by the pressure pins *B* 2 to reverse the shell and form the shoulder of the cover.

The Punch

Fig. 6 is the double-action drawing punch made in two pieces as follows: *C* is the main part of the punch and is of cast iron, threaded at the top end to take the extension of the press, and has a flange *C* 2. *C* 1 is the sliding collar which is held in position by several shoulder screws which allow it to be flush with the nose of the punch. The punch proper *C* and sliding collar *C* 1 have pockets into which are placed heavy compression springs of sufficient resistance so that in drawing the blank this sliding collar *C* 1 will not move back until it rests in the form of the die. This punch also is supplied with a vent hole to allow air at this side to escape.

The Assembled Tools

Fig. 7 is an assembly view of all the component parts of the die, and the heavy black line through the center denotes the blanks in position to be drawn. Particular attention is drawn to the diagonal lines *D* 1, 2, 3, 4, which denote the sliding spaces of both drawing rings, and sliding collar of the punch, also the relative position of the flange of the punch *C* 2 to the pressure pins *B* 2 in the blank holder designated as *D* 5. In the action of the die the sliding ring in blank holder *B* 3 comes in contact with *A* 2 and is forced back against its base or shoulder, and in turn forces *A* 2 level with the top of the die and puts the strain of the draw on the springs contained in the pockets of the die. It will be noted that the sliding collar of the punch is still in its original position.

Fig. 8 represents the movement of the die more than half completed, and shows the blanks drawn as in Fig. 2, flat bottomed. Note that the spaces of sliding rings on die and blank holder, also on punch, designated in Fig. 7 as *D* 1, 2, 3, 4, and now as *E* 1, 2, 3, 4, are exactly the same. Attention is called to the flange of the punch *C* 2 in relation to pressure pins *B* 2 and shown as *E* 5. To continue: On the downward action of the punch, sliding collar *C* 1 draws the shell until it bottoms in the form of the die, and then is forced back to its base. In so doing, it acts as a blank holder, and the shell is drawn into the lower form by the nose of the punch being gradually forced through in the downward action. While this downward action is taking place, the flange of the punch *C* 2 engages the pressure pins *B* 2 in the blank holder, which forces the pressure or sliding ring *B* 3 in the blank holder down; these in turn force the blanks around the form of the die, and force the die pressure ring *A* 2 to its base and the result is as represented in Fig. 9.

The Completion of the Work

Attention is again called to the diagonal lines *F* 1, 2, which are now reversed from Fig. 7, *D* 1, 2, 3; *F* 4 shows the sliding collar *C* 1 of punch *C* against its base, and at *F* 3 which shows the relation of the flange *C* 2 on the punch to the pressure pins *B* 2 in the blank holder. The heavy black line represents the shells drawn full depth, and the completion of the downward or drawing action of the die, which is double action up to the engagement of the flange on the punch with the pressure pins, when the die then performs the combination-die functions in addition to the double-action work already described. The shells are then ejected and will be found without a wrinkle anywhere and all ready to be headed and trimmed, which is the finishing operation.

In closing I will state that both tin and black plate have been drawn in this manner, and the method has proved entirely successful and practical.

Bar for Boring Crosshead Guides

By Charles Fosdick*

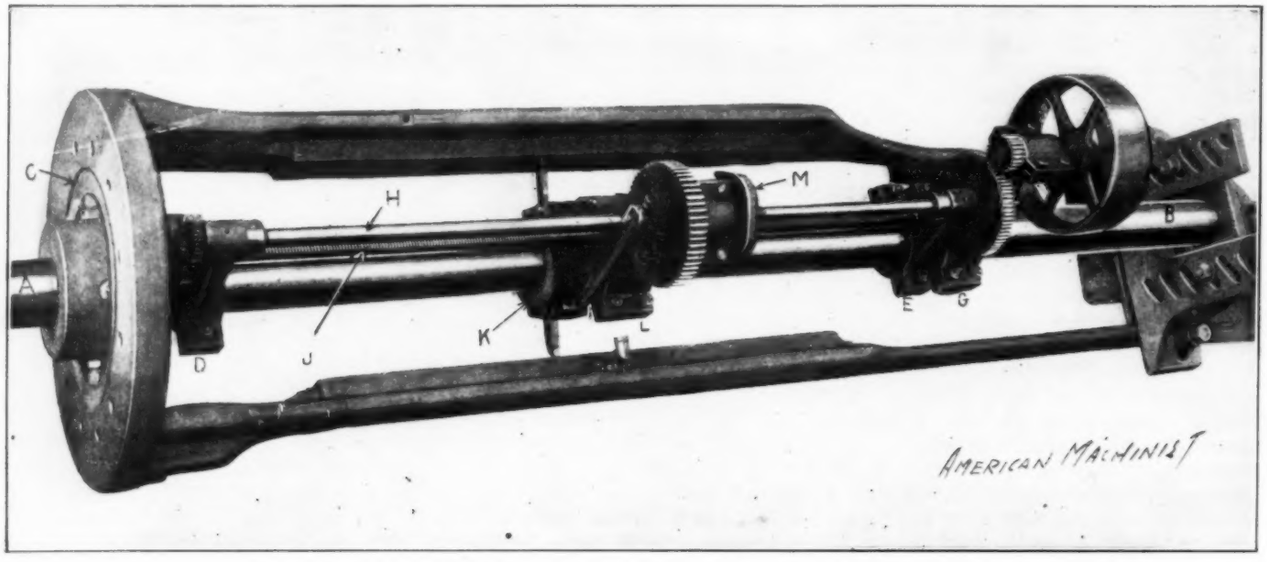
Bored crosshead guides have great advantages over planed ones if the boring is done correctly, as a crosshead with adjustable gibs having turned surfaces places itself in the guides naturally, accommodates itself to change in level of main shaft bearing by wear of the main boxes and allows of better oiling than flat or V-guides provide, and there is much less liability to slight errors in workmanship affecting the perfect alinement of the parts.

Bored guides require to be perfectly true with the cylinder and frame center line. The method employed by the Fitchburg Steam Engine Company to do this work upon what is named the "girder" style of frame is shown in the accompanying cut and the following is a description of the mechanism.

A turned bar *A B* is centered by a cathead at *A* and a U angle iron at *B*. Using this bar as a mandrel both ends of frame are faced in the lathe and the cylinder end is counterbored at *C* to receive centering lock on cylinder head by which the cylinder is accurately centered upon the frame.

This central bar *A B* is key-seated its length and after ends of frame are faced, the housings *D E* are clamped upon it,

*Superintendent, Fitchburg Steam Engine Company.



Boring Out Guides with a Reciprocating Motion

being keyed in the slot to bring them to position around the bar. These housings support the driving shaft *H* and the threaded feed rod *J*. At the driving end there is another housing *G*, which carries a driving pulley and upon its shaft a pinion engaging the gear keyed to the driving shaft.

Between the end housings and sliding upon the central bar is the cutter head *K*, this being made in halves and bolted together to make a running fit on bar *A B* and carrying a tool or cutter on each half. The cutting points are set equally distant from the surface of the bar and this cutter head is given a reciprocating motion upon the central bar by the rod connecting the cutter head, as shown, to a pin in the gear which is mounted on a short shaft carried in still another housing *L*. This housing is a sliding fit on bar *A B*, sliding on its feather in the slot in the bar the gear last mentioned being driven by a pinion feathered on the driving shaft *J*.

On the other end of this gear shaft at *M* is keyed an eccentric. The eccentric strap is extended to a clawpawl which moves the feed ratchet threaded upon the feed rod. Convenient means is provided for unlocking the feed and returning the housing *L* and cutter head *K* to their starting position as well as for adjusting to coarse or fine feed and for adjusting the stroke of the cutter head to meet various diameters of bore and width of guide. By reciprocating the head and its cutters instead of a full rotation, the back bone or rib of the frame can be brought up close to the guides for strength and the work is more quickly performed, there being less waste motion of the tools while not cutting. The result is that a true bored surface is obtained at the least expense of labor and investment for tools. This tool has been in successful use for many years and was designed for the special purpose accomplished.

Laying Out Master Plates

By C. A. Guion*

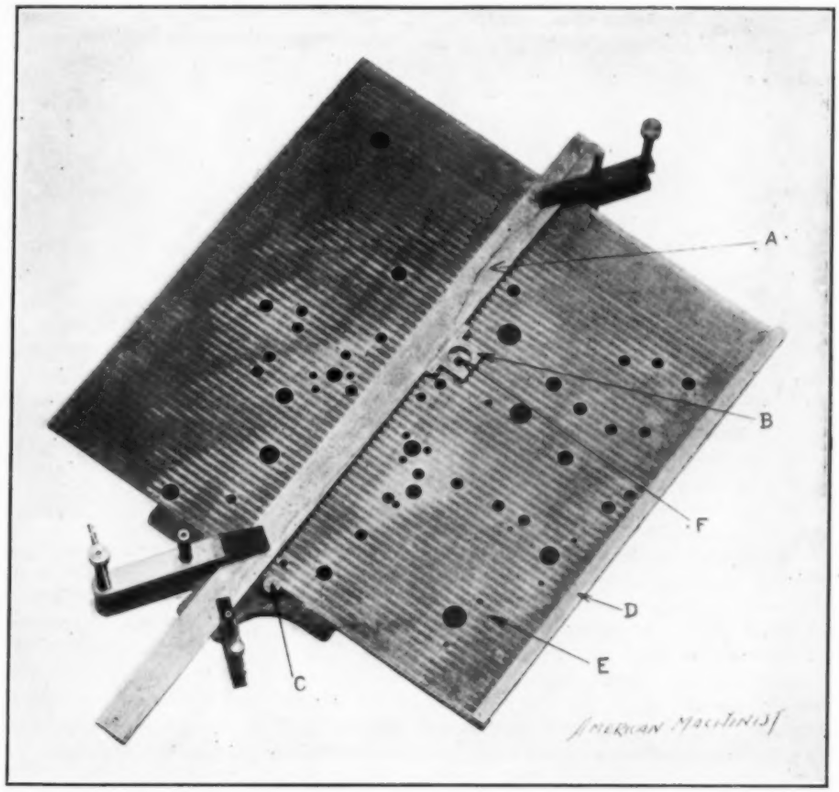
The use of master plates is rapidly extending in high-class machine manufacture. The National Cash Register Company has a large number of them, and in duplicate for working and reference purposes. In the making of these plates we have developed the method shown in the accompanying halftone and have found it both accurate and expeditious.

In the drawing of a plate the holes are located by dimensions from horizontal and vertical base lines, these lines being respectively the bottom and left-hand edges of the plate, which is, at the beginning, made with these edges truly square with one another. The laying-out device is a T-square having a loose head which may be adjusted anywhere lengthwise of the blade *A*. Attached to the blade by means of screws and dowel pins is a plate *B*, having a hole *F* at a known distance from the edge of the blade, and inserted in the head is a stud *C*, having its side exactly flush with the inside edge of the head and its center at precisely the same distance below the edge of the blade slot as is the center of the hole *F* below the edge of the blade. The hole *F* is of standard size and going with it is a series of standard plugs and bushings—the former for use when making the settings and the latter when making the holes in the master plate. A strip *D* is located temporarily on the lower edge of the plate *E*, its outer edge exactly agreeing with the corresponding edge of the plate. The object of this strip, of course, is to raise the base line from which measurements are made, so that the measurements may be made parallel with the surface of the plate.

To explain the manner of using the square, imagine that we have to locate a hole in the plate at, say, eight inches from the left-hand edge and six inches from the bottom. A plug having a standard head the same diameter as *C* is placed in the hole *F* and the head of the square is then adjusted on the blade by means of a micrometer or vernier until the edge of plug *C* and the center of the plug inserted in the hole *F* are exactly eight inches apart, when the blade is clamped to the head as clearly shown. The square is then placed on the plate and by means of the micrometer or vernier, the center of hole *F* is located exactly six inches above the edge of the plate, when the blade is clamped to the plate as shown.

The plug is then removed from the hole *F* and a hardened slip bushing is inserted, transforming the blade into a jig for the drilling of the hole. After drilling, the slip bushing is removed and another, suitable for a rose reamer, is inserted and the hole is then finished.

It will be seen that this system of operation is direct and rapid, largely because we have but one dimension to deal with at a time, and that a high degree of precision may be obtained.



Adjustable T-square for Laying Out and Drilling Master Plates and Similar Pieces of Work

*Foreman, model making department, National Cash Register Company, Dayton, Ohio.

A Standard Sheet Metal Gage

A bill has been introduced for making the standard gage for sheet or plate iron or steel, which was adopted as the United States Standard in 1893, compulsory in all the localities over which the Federal government exercises direct control.

Section 2 of the act provides: That it shall be unlawful for any person in the District of Columbia, or in any Territory or possession of the United States, to sell or offer to sell, deliver or offer to deliver, in fulfillment of any contract of sale, any sheet or plate iron or steel of any other gage than that hereby established.

Straight Piecework versus Premium

By Ferd. B. Jacobsen

One point against the premium system is that the greater the production the less the rate per piece. Straight piecework has several important advantages. The wrong of piece-rate cutting.

Some kind of a system, no matter how poor, is generally better than none and a premium bonus system, therefore, is better than straight daywork especially for the employee. That the employer at times gets a benefit therefrom is natural, but at other times, especially when the premium limits are not set properly, as in places where cheap and inexperienced clerks with no practical knowledge are set to look after it, the work is costing more than it would on ordinary time work.

When times are good and the work is being rushed the man with a little or any ambition in him is going to try to make more than his day rate by making a bonus. In this case the premium system works pretty satisfactorily as far as the cost is concerned. But on the other hand if work is scarce the full limit may be taken and still, of course, the operator receives his dayrate. Now the limit is in a good many cases about 50 per cent. above the actual time necessary for the operation and consequently in this case the employer is losing just that amount. Not only is he paying that much more in actual cash, but he is losing that much efficiency of the machine.

In a factory each square foot of floor-space is worth just so much money and has to earn its rate, if not it is a losing game the same as a house without a tenant. When the premium limit is 50 per cent. over the actual time required, the bonus is generally one-half of the time saved. When the premium limit is 100 per cent. over the actual time, the bonus allowance is about one-third of the time saved. I have seen cases where the premium limit has been 300 per cent. over the actual time, due to the fact that the man in charge of setting the premium limits did not know his business and had no practical experience.

The whole premium system in a nutshell is this: The employer guarantees to give the employee a bonus if he finishes a piece of work in less than a certain specified time. In return the employee does not promise anything and cannot lose anything by it. If he finishes his work in less time, good and well, he will receive a bonus, but if he has a good dayrate and cares to be lazy, as is only too often the case, he will receive his wages just the same. It is a very one-sided proposition and the working man who objects to a premium system does not know where self-interest lies. Still some people object to everything just because they do not properly understand.

I have heard of cases where the men had objections to installing a premium system by which they can lose absolutely nothing. Beside being without any very great benefit for the employer, as far as the saving is concerned, it is a very expensive and complicated system as far as cost keeping is concerned. It is hardly possible ever to get the same cost twice, It will vary anywhere from 1 to 100 per cent. It is a very flexible system and easy to install for the reason that if mistakes are made they will not be so very expensive, as the operator only gets from ½ to ⅓ of the time saved.

My personal opinion about a premium system is, that it is good enough for those who do not know, but a man who thoroughly understands his business will certainly insist on having his employees' work nothing but piece work, wherever it is possible to do so, and it is possible on all production work.

Reason for One Combination System

Not very long ago I had an interview with an official of a very large manufacturing plant and asked him what system he employed in his shops. His answer was, that they worked piece work except on the automatic machines, on which they used the premium system. Now this being my special line I knew immediately where the nigger was hidden. Why did they work premium on the automatics' and piece work on all the other machines? The answer is very simple. It was easy, at least we will say comparatively easy, to set prices on work done on ordinary machines run one at a time by one operator, but when it came to the automatics it required some hard thinking and brain work, plus practical knowledge and experience, which our friend in charge of this work evidently did not have, or possibly he did not have enough time to think this matter over properly. That is very unfortunate and I dare say that these particular machines are not turning out as much work as they should, nor as cheaply as they should.

Only One Theoretical Point Against the Premium System

The only point a workman can bring up in regard to the premium system, although only a theoretical point, is that he is not getting as much for the last piece as for the first one. The more he does, the less he gets per piece.

Premium bonus systems are worked in many different variations and under different names, but when it comes down to a final analysis, they are all the same; all branches from the one tree.

Piece work is the thing! I have never yet met a man with any ambition and common sense, who after giving the problem proper consideration would not rather work on the straight piece-work basis than under any other system I know of, unless his day rate was so high that he did not care to exert himself.

Piece prices, if set properly and on a scientific basis, can be applied to any type of machine, whether the operator runs one or five simultaneously. They may be screw machines of various types and makes yet piece prices can be set to take care of all conditions; if done properly one single price for one piece of work on a certain machine will take care of all conditions, whether one or two machines are standing idle or whether the full number of four or five are running. This is a very interesting proposition and the most difficult problem in the piece-price business to take care of properly.

Of course, the setting up of the machine must be taken care of separately. For the manufacturer the piece-work system is the ideal system, as he will know how much a certain machine or part is going to cost and, therefore, cannot make any mistakes in estimates. It is easy to keep his piece-price records and it is possible at a glance to see just what each single operation of that part is going to cost. The data sheets if kept properly, or at all, will show just how many pieces per hour each individual machine is going to turn out and the man who handles his piece-rate department properly will, as soon as he picks up a man's time card, know whether that man or machine is doing what it ought to do.

This item alone will save a big concern with a large production a considerable amount of money, which during the year will more than pay the salary of the man who takes care of the piece-work system.

A Brief Comparison

Comparing the piece-work system with the premium system, the former shows up at a great advantage and I have found it possible to reduce the cost from 10 to 90 per cent., the higher figure, of course, being due to the fact that great carelessness and very little practical knowledge was shown in the setting of the premium limits. Beside reducing the cost, the production will be increased considerably by working

straight piece work. The man knows that he only gets paid for his actual work and he keeps at it. He also knows that if he does not do his work properly he will not get paid for it.

Piece work, if set properly, is fair to every man in the shop as every man gets the same price for the one piece of work, whereas on the premium basis, if two men with different day rates are working on the same job the one with the higher rate is getting more than the other.

On piece work the individual or the man's rate makes no difference. If the machine rate is 30 cents per hour and a 20-cent man is put at that machine, he will receive the same price and will make as much money as the other, provided he is able to turn out the same amount of work. He gets all he makes, the last piece will pay just as much as the first.

The Wrong of Price Cutting

It is wrong and shows great ignorance and inexperience on the part of a piece-rate man, if he is thinking of cutting a price as soon as a man makes a little more money than usual. Now, I wish to say that this is a good sign, a sign that the operator is taking interest in his work and is a hustling and efficient worker. This man, if his work was done properly, deserves all the money he can make. The chances are that if another man is put at his work he would not be able to make so much money. It is the man who makes exactly the same day after day and week after week who needs more attention. It is very likely that he is holding back production which is one of the gravest mistakes he can make. If the operator would understand that the price set on a piece of work is satisfactory to the employer, provided, of course, that it had been set properly in the first place, and that the thing the employer wants is production, he would not be afraid to turn in his work.

I know that experience has taught a good many men that as soon as they turn in more than a certain amount of work the piece-rate clerk takes it as a chance to cut the price. I dare say this style of piece-rate clerk is costing the firm that employs him a considerable amount of money and is doing more harm than good, due to his ignorance, narrow-mindedness and lack of practical experience.

It is this in many cases that hampers the success of the piece-work system; the men grow suspicious and as a consequence are afraid to show what they can do. It pays to treat the operator with consideration and investigate his complaints if he makes any, provided he is not one of the "chronic kickers." And remember it may be necessary at times to raise a price to take care of certain unforseen conditions.

There are hundreds of little things to consider. Human nature is one. If everything is given the proper attention, there is no reason why the straight piece-work system should not be looked upon with favor by the employee, who through it will make more money. As for the employer it will save him a vast amount of money and unnecessary labor.

The Foundry Patternmaker

By William H. Parry *

From an address before the New England Foundrymen's Association, pointing out some of the requirements of a good patternmaker for modern foundry work.

*Superintendent, National Meter Company, Brooklyn, N. Y.

The term a foundry patternmaker is an opprobrious name sometimes hurled at the head of any poor unfortunate who, in the raffle of this world's chances for a means of making a living, happened to draw the opportunity to learn his trade under such conditions that gave him a fine chance to size up what the molder had to contend with in the line of badly constructed patterns. These, in many instances, were made by good woodworkers, but who had as much conception of the art of molding as a jackass has of the science of astronomy. Yet, this class of patternmakers are largely in evidence today for the reason that the old-fashioned shops are fast disappearing and the opportunities for the acquisition of foundry knowledge are confined to large manufacturing plants, which number a foundry as one of the component parts of a complete whole.

What this country is coming to in the light of what is happening to our young men who have taken up patternmaking as a means of livelihood is hard to say. But I will venture to predict that, unless there is a very decided change in the methods employed in instructing the young patternmaker, the foundrymen who come after us are in for a very interesting time.

Now, what is a first-class foundry patternmaker? First, he is a man who has served enough time in a foundry as a molder to have learned that molders are also mechanics. If he is a fair-minded man he realizes that, considering the means that molders use to turn out good castings, they are, man for man, even better mechanics than the generality of patternmakers. Having once realized this, he is in a position to respond to any little suggestion that the molder may make looking to the betterment of foundry conditions.

Second, experience has taught him that to slight the pattern work only entails more work on the molder, and when we stop to consider that the molder's tools consist largely of a sand heap and some boxes (either iron or wood), and proper, and in many cases improper, means of handling the same, it is surprising that they are able to do so well. So the foundry patternmaker, realizing these conditions, does everything in his power to make patterns that can be molded with the least possible trouble to the molder, which means, of course, a great output.

Poor Patterns Restrict Output

In fact, I do not know of anything that will compare with poor patternmaking as a means of restricting the output of any foundry. Those of us who have been up against the task of making castings from patterns made in the various jobbing pattern shops in our locality, can appreciate how little the owners of said pattern shops know or care as to whether the castings can be made or not from such "creations" as they are wont to make.

This brings us the crying necessity of teaching young men who serve their time in such shops, the first rudiments, at least, of the molding art. In fact, I have met with middle-aged men who had never worked anywhere else but in jobbing shops and whose knowledge of molding was of a kind that made molders weep and—swear.

What Makes Good Patternmakers

Now we will take up as briefly as possible several little things that go to make the foundry patternmaker. He never fastens anything on the cope side of his pattern that ought to be loose and whatever is fast is given enough draft to insure a perfect cope lift. He never allows his patterns to leave his hands with lumps of glue right in line with the deepest lift. He never expects a molder to stop off five feet from a six-foot pattern. He never forgets to provide lifting straps when necessary. He never has his dowel pins so tight in dowel holes that it would take a Sandow to part the patterns. He never provides a very shallow ring when he wants a very deep drum cast from it by the never-to-be-forgiven process of lift a half an inch and ram a half ar

inch. He never allows a pattern to leave his hands until it has received at least two coats of varnish and by varnish I do not mean jobbing-shop varnish, but that of a good grade that will not shed its coat on the sand if it happens to remain there for any time over five minutes. He never forgets to mark the loose pieces properly so that their correct position on the pattern is not a matter of guess. He never places rapping plates on patterns in such crazy positions that the molder cannot possibly use them. He never would be guilty of making patterns with "back draft." He never expects that because they use cranes in the foundry it would be an infallible method of lifting patterns from the sand, hence they need no draft; and he never, never makes the remark that anything is good enough for a molder.

Molding-machine Work

In these days of the molding machine, the foundry patternmaker looms up as a very important man indeed, and, notwithstanding that molding machines have been used pretty extensively for many years, it was my misfortune to meet a patternmaker not six months ago who admitted to me that he had never heard that such vile things were in use, and after he had worked for us a while I believed him.

My advice to any patternmaker who aspires to become conversant with molding-machine pattern work is to forget some of the old established rules and train his mind to the new conditions. Then, when he is called upon to produce patterns that can be plated or stripped, he will know enough to make them in such a manner that the molding-machine operator does not have to do any thinking or patching in his efforts to make a showing with his machine. Here is where our old friend, the foundry patternmaker, will be on the job once more, delivering the goods as of yore, be it bench work or floor, with or without core.

Cost of Using a Handy Man

I will cite an instance of very recent occurrence that will convince you of the need of a foundry patternmaker in one shop at least. A jobbing foundry—one of the largest in the country—recently installed a jarring machine. The salesman told them that their handy man would be fully competent to set patterns on plates so that they would be relatively correct to the pins, and acting on these instruction, they proceeded to place a gas-engine cylinder pattern on two plates so that they could run up, say, a half a dozen copes from one plate, then change over and ram up the same quantitity of drags. Everything went lovely until they yanked the castings out and then consternation reigned supreme, as it was found that each half of the casting lapped over the other halves about a half an inch.

Did they seek the cause as mechanics would have done. Not so. They went for the molder and the flaskmaker and accused both of being responsible for a "shake" in the flasks; then they tried the flasks and found that they were all right; then, and not until then, did they examine the plates, only to find out that their handy man was a very unhandy man, indeed, when accuracy of position was desired. They made another trial and, when the next batch of castings were turned out they were just as bad, only they lapped the other way. Then they cursed the machine and its maker, and it was a good thing for him that he didn't happen to visit them just about then, as he might have been blessed!

After they had cooled down, they decided that their class of help was not of a kind that would make a success on that machine, so they consulted with a man experienced on that class of work, and he lent them a man who fixed them up in good shape. In fact, in such good shape that they made him an offer to stay with them without the usual formality of asking the lender for his permission, and to the everlasting credit of the man who was loaned, be it said, he spurned their offer, although it meant more money for him. And so I say that the foundry patternmaker is *the* man to tie to in these days of the molding machine, and if you have one in your employ that can do all these things, he is worth his weight in platinum to you. And I would say the same of any good molder. Such, for instance, as a man who was recently asked to turn out 50 molds a day 12 feet by 16 inches by 5 inches, with eight patterns, on a Tobin bronze plate, so made that by the use of false cores it was possible to make the castings in a two-part flask with an extra roll over. Considerable thought had been devoted to the method of assembling the patterns, and we were patting ourselves on the back that we had struck a pretty good thing, but the first day's work was very disappointing, and the second was but little better.

The molder then suggested that instead of eight individual false cores, we make a frame to drop on the plate so that it would surround all the patterns, thus making one large false core instead of eight little ones. He also suggested that we change the draft in certain places, which was done, and because of these two changes, we got a very good day's work, though it is but fair to admit that we didn't get the 50 molds that we were after, as we found that it was a physical impossibility for any one man to do it in 9½ hours.

Perhaps some of you have had the experience of trying to hire metal patternmakers who were conversant with uptodate molding-machine practice, and possibly you have had the heartrending troubles incident thereto. Such, for instance, as hiring men who claimed to have all the necessary experience that makes for a first-class man, only to find in a very short time that they were mere pattern filers, whose knowledge was decidedly limited and who knew absolutely nothing of molding-machine practice. Indeed it is a question whether some of them even knew what the word "draft" meant.

If you have not been through this mill, I stand before you as a horrible example of one who has, and with your permission I will recite the facts, hoping that someone will benefit thereby. It's all very well for the molding-machine salesman to tell you all you have to do is to put the patterns on the plates and the machine will do the rest. I fell once, but never again.

Importance of the Operator

I very soon found out that not only did much depend on the proper placing of patterns on a plate, but that the molding-machine men themselves at their home plants were not able to set patterns on a plate properly. So there was nothing to it but to buckle down to the game and organize our own force in such a manner that these troubles would cease for all time. To that end we pressed into service some young men who had served their time with us as wood patternmakers, and they made good right from the start. When you come to think it over there was no good reason why they should not, as they had a fair working knowledge of foundry practice to the extent at least of knowing what draft really meant, and as a result we have a force of men today who can make their own master patterns. And by master patterns I mean real master patterns so made that there is the very minimum of finish allowed and the workmanship to pass muster must be of the best. The same men then are able to finish the brass patterns and top it all off by setting them on molding-machine plates and make a trial mold before the rig is returned to the foundry.

Wood patternmakers as a rule do not care for metal-pattern work, but, as I have explained to them many times, in this age of molding machines the more versatile a man makes himself the better and more valuable he becomes to himself and employer, and the more money he is going to earn. Of course, there are exceptions here and there, and I know of a case where a former wood patternmaker devotes his entire time to metal patterns.

A good way to fasten a wood handle onto a tool is to fill the hole full of shellac; then heat the shank of the foot almost red and press it home.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Manufacturing Shafts—Piecework

Having been in charge of a shop which produced a large number of shafts of various sizes and lengths, I was somewhat surprised to find when introducing piecework, how little I knew on the subject, and what a lot the man on the job knew about it. Before starting piecework, I was not at all satisfied with the time taken in roughing out the larger sizes of shafts from 2 inches diameter by 6 feet long and upward. To help things along I had a roller steady rest made to replace the old type of steady rest with wood blocks. This was looked upon as a great improvement and brought about a fair reduction in time. Some time afterward, the man was started on piecework and had hardly settled down to the new arrangement before he was found to be again using the old steady rest and wood blocks. On being approached he gave the explanation that the roller steady was all right but it took a long time to prepare a bearing on the shaft for it, as it had to be perfectly round, while his wood blocks would hold the shaft all right even if the bearing was not exactly round. Further, what he gained in cutting speed with the roller steadyrest he more than lost in getting ready to use it.

His pay envelop proved the truth of this, so the roller steady was laid aside. An improvement in the milling of the keyways (one of which was required at each end of the shafts) was made some time before commencing piecework. Instead of marking off and clamping the shafts singly on V-blocks on the milling-machine table, I had a set of multiple V-blocks made, designed to handle four shafts at a setting. I also got several sets of four cutters to suit the various sizes of keyways; the method of working being to cut the keyways in one end of the shafts, then raise the cutters, run the table along and repeat the operation at the other end of the shafts.

The shafts coming through in from two- to six-dozen lots according to requirements, we soon made things hum in the keyway line and when starting under piecework a pretty low rate was struck for this item. So low in fact that the operator asked permission to try another method, in the hope of getting, as he put it, a decent wage. He put the shafts along one of the T-slots of the table, using a stop and single clamp to hold the shaft in position. After cutting the keyway in one end, the table was run back and the shaft reversed for the second keyway, the whole of each lot of shafts being completed without any altering of the cutters, thus making them all of uniform depth, and the job was done quite satisfactorily in every way, there being no necessity for having the keyways in line. The operator's pay envelop was so satisfactory that I was able to add all odd shafts into the scale and also to make over to him the entire responsibility for all keyways, he getting the necessary information from the drawing. The multiple V-blocks were cremated on account of their uselessness.

Piecework was also introduced in the grinding of these shafts, the work being distributed over three machines. It was found that the man who did the best work and also earned the most pay, was not using his automatic feed.

When approached on the matter, he explained that he could keep the wheel true much longer and also take a heavier cut by using the hand feed. The others ultimately followed his lead, but I have not relieved the machines of this encumbrance and have no wish to advise the machine makers to do so.

Belfast, Ireland. TERRY.

Tray for Draftsman's Instruments

I have noticed in technical magazines that articles often appear pertaining to the fact that draftsmen have too many tools on the board when working and advising them to try to avoid it, as they get in the way.

I find in designing that at times one is compelled to have more than one would like to have on the board, but by a few minutes' work with scrap pattern wood any draftsman can overcome at least one cause for cuss words.

Take a thin piece of wood, say 6x12x3/8 inch, and put a small strip of wood around the edge, say 1/4x3/8 inch, so as to make a tray. A draftsman can put all his tools in the tray and use what he wishes; when through, put them back in the tray. The drawing has no opportunity to get dirty from the tools and when the supervisors inspect the work before completion all the tools can easily be removed at once.

Binghamton, N. Y. J. H. C.

The Persistence of Linear Measurements

It has been emphasized at various times that linear measurements are irrevocably tied to the past, and the truth of this saying has been abundantly demonstrated, but it is not always realized how brief a past is necessary to determine the permanence of a series of dimensions.

Probably one of the most interesting examples of this fact appears in the matter of the sizes of balls for ball bearings. The *Deutsche Waffen- und Munitionsfabrik*, a large establishment in Berlin, making, as its title indicates, firearms and ammunition, is also an extensive manufacturer of ball bearings, and its products are widely sold in the United States. In its handsomely printed and illustrated catalog there appear diagrams and illustrations of ball bearings for a great variety of purposes, together with a tabulated list of steel balls, of various sizes. The dimensions of the different parts of these bearings are given in millimeters, with the exception of the balls, these being stated in *fractions of an inch*, ranging from 1/16 of an inch, English, to 5 inches in diameter. In the heading of the table of steel balls it is stated that balls are furnished *"in jeder beliebigen Grösse von 1/16 Zoll engl. ab."* (in any desired size from 1/16 inch English, up), and the table runs from 1/16 inch by 32ds up to 17/32, and thence by 16ths up to 2 inches, and thence by 8ths up to 4 inches, and by 1/4 inch to 5 inches.

Since all other dimensions of these German-made bearings are given in millimeters, I was curious enough about it to write to the American representatives to inquire about the reason for this mixed nomenclature, and received the following reply:

"You inquire concerning the mixed nomenclature in all data on balls and ball bearings, and I can explain that in this manner: The present so called Cleveland process for the manufacture of steel balls originated in Cleveland, Ohio, some 15 years ago. The D. W. F., of Berlin, saw further possibilities in it and purchased manufacturing rights. After the expenditure of considerable effort the process was made the commecial possi-

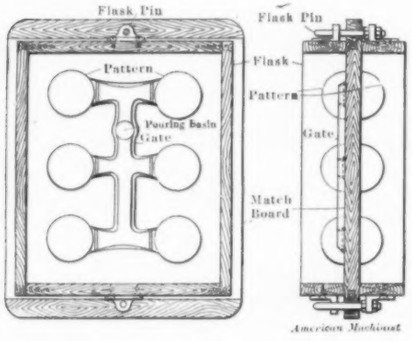
bility that it is at present; throughout, however, *the original American sizes were retained.*" (The italics are mine).

That is to say, it was found impracticable to eradicate, even in so brief a period as 15 years, in the heart of Germany, the use of the English inch after it had once got a foothold, and every year doubtless finds it intrenched still further, just as is the case with the Whitworth screw-thread system. All the elaborate researches of Professor Stribeck upon ball bearings give the diameters of the balls in fractions of an inch, and the formulas which he derived for use in that connection include this notation, and in various technical papers and other publications the inch dimension of steel balls for ball bearings in countries which have *adopted* the metric system maintains itself without effort and almost without the knowledge of English or American engineers. See *Die Hütte*, etc.

HENRY HARRISON SUPLEE.

Making and Using Match Boards

The operations of the molder are, to a large extent, predetermined by the patternmaker; hence the latter should have a knowledge of foundry work and the patternmaker who has attained a practical knowledge of molding is capable of



MAKING AND USING MATCH BOARDS

meeting new conditions to the best advantage; though the writer has learned that it is advisable before starting on difficult jobs of patternmaking or special lines of pattern work—match-board work for example—to consult with the foundry man so that the work may be intelligently planned from the beginning.

Patterns are mounted on match-boards when the castings are wanted in large quantities and the molding is to be done by men who are not experts in foundry work, and while these men cannot be classed as molders, nevertheless they soon become experts in this branch of foundry work, speed and quantity following.

In some factories, automobile factories for instance, match-board pattern work is about as common as the regular work, and the foremen in charge being experienced in this class of work, give the patternmaker little or no trouble in turning out work that will meet all of the requirements of the foundry man.

I worked in the pattern department connected with one of the large automobile factories which operated its own foundry, where the greater part of the molding was done with match-board patterns, and while familiar with the various sizes of flasks and also the general foundry equipment and conditions, yet a job of match-board work was never started without first consulting with the foreman of the foundry.

There are, in every foundry, conditions and equipment that must be considered when planning and making match-board patterns, therefore, the first and most important detail is to consult with the foundry man and learn from him the best and most practical way to make the match-board in order to be sure that it will answer all of the foundry conditions. If patternmakers would consult with the foundry man more often, there would be a better feeling existing between those who follow these trades and the work would progress with more satisfaction to all concerned.

An example of simple match-plate work is shown in the accompanying line cut. This pattern is for 2½-inch cast-iron balls, which are used in an anti-friction turntable, the diameter of the ball race being 12 feet from center to center.

The instructions accompanying the drawing read as follows: Wanted, pattern for ball 2½ inches diameter. Number of pieces (balls), 350; order completed. Rush. Pattern special. By "pattern special" is meant that the pattern is to be used for this lot of castings only. These instructions are shown to the foundry man, who, after due consideration, selects from the flasks on hand a small snap flask and he selects a small one, because: (1), Six patterns gated on a match-board will fill the flask; (2), there are only 350 pieces wanted; (3), with six patterns he can fill the order on time; (4), this is a special order and when filled the pattern or match-board is to be used no more; (5), because six patterns on a match-plate keeps the pattern cost down to a minimum and, at the same time, is a sufficient number to answer all of the foundry requirements.

Now let us suppose that the instructions on the order had read "standard," meaning that the pattern was to be used indefinitely. This would change the entire proceedings both in the pattern shop and foundry, and the largest flask, either regular or snap, that could be manipulated by one molder would be selected, and the number of patterns mounted on the match-plate would be between 20 and 30, particular attention being given to the size, shape and position of the gate, and also the thickness and notching of the gate where it joins the pattern, to allow breaking off without "breaking in" or damaging the casting.

The match-board in the sketch is made of pine, though very often hardwood or metal plate is used, and patternmakers who have little knowledge of practical foundry practice, often insist that this board must be made a standard thickness, which is not true, as a match-board can be ¾ inch or 6 inches in thickness, but must be of equal thickness throughout, with both surfaces true and flat. The writer usually makes small plates from ⅞ up to 1¼ inches in thickness.

Care must be exercised in putting the gate on the board, though in this match-plate either side will answer for the cope, owing to the fact that both sides are alike.

Different metals call for special gating, and with brass, aluminum or bronze, the gate is put on the cope side of the board, but for iron the gate is in the drag, though these are details that should be left to the foundry man to decide.

Milwaukee, Wis. JOHN BROWN.

Injudicious and Expensive Selling Methods

While the following up of inquiries is an excellent thing, it is a question whether, when injudiciously pursued, it does not lose many sales. A case where this is true is in the custom of many concerns of sending a salesman in answer to every request for a catalog. There are many persons connected with a manufacturing plant who have nothing at all to do with the purchasing department, and yet whose advice or suggestion might result in the trial of some line of goods.

Suppose a draftsman wants to call for a certain material or commercial part. He sees an advertisement which might or might not answer his requirements. The natural thing would be to write for a catalog, but he knows that this will result in a visit from a salesman, who may feel aggrieved at a useless trip. So to avoid this he uses something which may not be so good, but which he happens to know about.

Or suppose a foreman wants a new boring mill in his department. He would like to read up on boring mills and select the one best fitted to his needs, but he knows that writing for catalogs will result in a deluge of agents. So he leaves it to the purchasing department to make the selection, not always with the best of results.

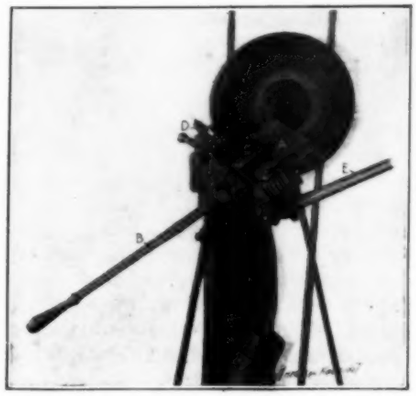
This may seem like a small matter, but it is a very real deterrent to many men, and while not all houses have this system, enough do to make the effect felt by all. It would seem as if this trouble might be obviated by sending agents in answer only to those inquiries which are written on a business letter head.

Camden, N. J. JOHN STROUD.

A Disk Grinder

The halftone shows a homemade disk grinder in use in the shops of the Atlas Motor Car Company, Springfield, Mass. It is used for quite a number of jobs which require fairly accurate grinding, among others for finishing the steel rollers for roller bearings to length.

The counterbalanced table *A* is swung by the lever *B*. A slide *C* is fitted in *A* and to this various jigs are fitted, the one shown at *D* being a species of V-block with eccentric clamping device to hold the rollers previously mentioned.



A DISK GRINDER

The slide *C* is actuated by the lever *E* through the rack and pinion shown. *F* is an adjustable stop to limit the motion of the slide *C*; this, in conjunction with a stop on the jig, permits work to be finished to fairly close limits.

New York. E. A. DIXIE.

Comparison of U. S. and A. L. A. M. Standard Bolts and Nuts

The accompanying table gives a comparison of United States and Association of Licensed Automobile Manufacturers' standard bolts and nuts, which may prove useful to designers in automobile and other shops.

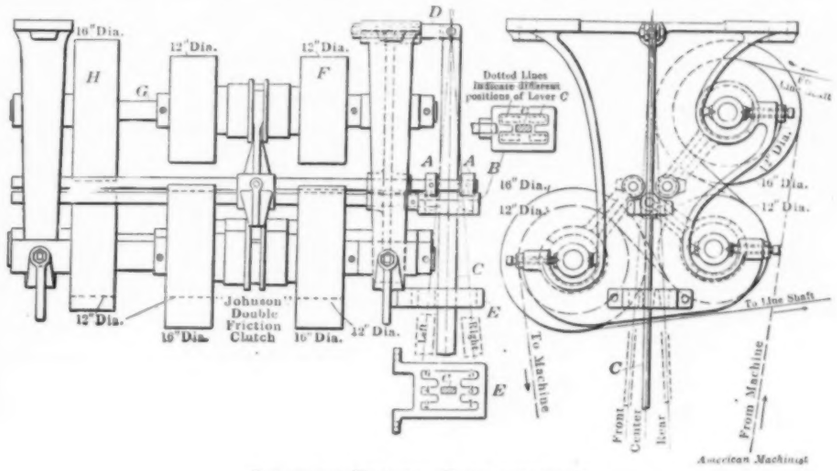
St. Louis, Mo. C. T. SCHAEFER.

Six Speed Belted Countershaft

Accompanying line cut shows a six-speed, belt-driven countershaft which was designed to take the place of a six-speed, gear-driven countershaft used on a certain machine and which was giving trouble.

There are two features on this counter which may be of interest to some of the readers; one is the method of driving three pulleys by one belt, whereby each of the friction pulleys, if coupled to the shaft, becomes the driver for the machine; the other feature is the shifter arrangement by which six clutches are operated by one lever and in such a way that only one can be engaged at one time.

This counter consists of three shafts journaled in self-alining boxes located in suitable hangers. Each shaft is equipped with three pulleys, one being fastened to the shaft, the other two secured to a Johnson double friction clutch. There are three shifter rods, each one having a fork which engages one of the friction spools.



SIX-SPEED BELTED COUNTERSHAFT

Position of Shifter.	Movement of Shifter Lever.	Speed of Pulley on Machine.
1	rear, right	$\frac{180\times16\times16}{12\times12}=320$ r.p.m.
2	rear, left	$\frac{180\times14\times16}{12\times12}=280$ r.p.m.
3	center, right	$\frac{180\times16\times12}{12\times12}=240$ r.p.m.
4	center, left	$\frac{180\times14\times12}{12\times12}=210$ r.p.m.
5	front, right	$\frac{180\times16\times12}{16\times12}=180$ r.p.m.
6	front, left	$\frac{180\times14\times12}{16\times12}=157.5$ r.p.m.

TABLE OF SPEEDS FOR BELTED COUNTERSHAFTS.

The two upper shifter rods are also each provided with two collars *A A*, and the lower rod with a yoke *B*. The shifter lever *C* is hinged in a swiveling fork *D* and can be moved either to the right or left, to the front, center or rear. It passes through yoke *B* and also through bracket *E*, which is fastened to the hanger and acts as a guide for the lever.

The line shaft, which runs at 180 revolutions per minute, is provided with a 16-inch and a 14-inch pulley, and on the machine is a 12-inch pulley. The 16-inch pulley drives the three friction pulleys next to the hanger. When the machine is not running, the shifter lever hangs vertically as shown in the sketch and any of the six speeds is instantly obtainable. When the shifter is moved first to the rear and then to the right, we get position 1, which represents the highest

Diameter of Screw.	Number of Threads per Inch.		Diameter at Root of Thread.		Area at Root of Thread, Square Inch.		Short Diameter of Hexagon.		Long Diameter of Hexagon.		Thickness of Nut.		Thickness of Head.		Tap Drill.		Tension at 10,000 Pounds per Square Inch.	
	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.	U. S.	A. L. A. M.
1/4	20	28	0.185	0.204	0.027	0.032	7/16	7/16	1/2	1/2	7/16	7/16	11/64	11/64	13/64	13/64	269	326
5/16	18	24	0.240	0.297	0.045	0.070	17/32	17/32	37/64	37/64	35/64	35/64	7/32	7/32	17/64	17/64	454	702
3/8	16	24	0.294	0.321	0.068	0.080	5/8	5/8	45/64	45/64	41/64	41/64	17/64	17/64	5/16	5/16	679	809
7/16	14	20	0.34	0.372	0.092	0.108	23/32	23/32	13/16	13/16	3/4	3/4	5/16	5/16	23/64	23/64	920	1085
1/2	13	20	0.40	0.435	0.126	0.148	27/32	27/32	29/32	29/32	55/64	55/64	11/32	11/32	27/64	27/64	1257	1486
9/16	12	18	0.45	0.490	0.150	0.188	15/16	15/16	1	1	61/64	61/64	25/64	25/64	31/64	31/64	1500	1885
5/8	11	18	0.507	0.553	0.202	0.240	1 1/16	1 1/16	1 1/8	1 1/8	1 1/16	1 1/16	7/16	7/16	17/32	17/32	2019	2402
3/4	10	16	0.620	0.660	0.302	0.351	1 1/8	1 1/8	1 1/4	1 1/4	1 1/8	1 1/8	31/64	31/64	41/64	41/64	3019	3515
7/8	9	14	0.731	0.783	0.420	0.481	1 5/16	1 5/16	1 7/16	1 7/16	1 5/16	1 5/16	35/64	35/64	3/4	3/4	4197	4815
1	8	14	0.837	0.908	0.550	0.647	1 1/2	1 1/2	1 5/8	1 5/8	1 1/2	1 1/2	39/64	39/64	55/64	55/64	5502	6475

COMPARISON OF U. S. AND A. L. A. M. STANDARD BOLTS AND NUTS.

speed; by this movement we clutch the 12-inch pulley *F* to shaft *G* and the 16-inch pulley *H* drives the machine. The table gives the speeds at the different lever positions.

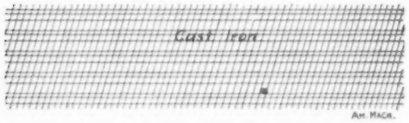
It will be noticed that before we can shift the lever to any other position the first movement always is to release the clutch.

Buffalo, N. Y. ROBERT JONES.

Drafting Short Cuts

Instead of using thumb tacks, I use a hammer made out of tool steel, hardened and magnetized; on which it is possible to pick up small steel tacks and drive them into my drawing paper or tracing cloth, whichever I am using. Then when wishing to take the drawing from the board, I use the claw end of the hammer and can take all of the tacks out without taking the tacks from the hammer.

The illustration shows just a strip of drawing paper ruled up for the size letter that you wish to make. Slide this under your tracing cloth and it will save you a lot of trouble ruling up for your letter-



GUIDE LINES FOR LETTERING

ing. Make your ruled strip long enough to project at both ends of your tracing so that you can slide it around easily. You will find that it also will improve the looks of your lettering, for the reason that it always will be the same hight. If you wish, you can run slanting lines across this so that all your letters will have the same slant. This could also be done with cross-section paper, but I do not find it as handy.

When making out a bill of material, rule up the glossy side of the tracing cloth, then turn it over and use the dull side for your lettering. If you have an erasure to make, you don't erase the ruled lines, so it will not be necessary to patch them up.

These little kinks may not be new to all, but I find that they come in very handy.

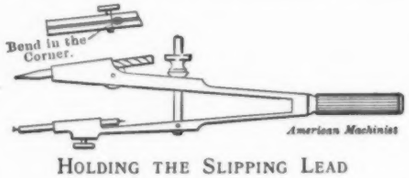
Athens, Penn. R. B.

Holding the Slipping Lead

The annoyance caused by the slipping of the lead in the compass, or bow pencil, when subjected to pressure, may be overcome entirely by making but a very slight change in either of the two named tools. Those who experience this trouble will be amply repaid by taking a few minutes time to make the required change.

Reference to the line cut shows a bow pencil with lead in place, and at the upper end of lead will be seen a thread. This thread is cut while the lead is being inserted. The corner indicated by the arrow is slightly depressed (some tools require a little filing at this place so it can be bent) forming a cutting edge. Now then; take a piece of lead about 1⅜ inches long, gripping it at the end between thumb and index finger; insert into the hole until the end meets the corner which is slightly bent in; then, as you push, revolve the lead to the right between thumb and finger and you will find a nice thread cut on the lead.

This thread should not exceed 0.005 inch in depth. The small screw is now tightened and the lead dressed in the



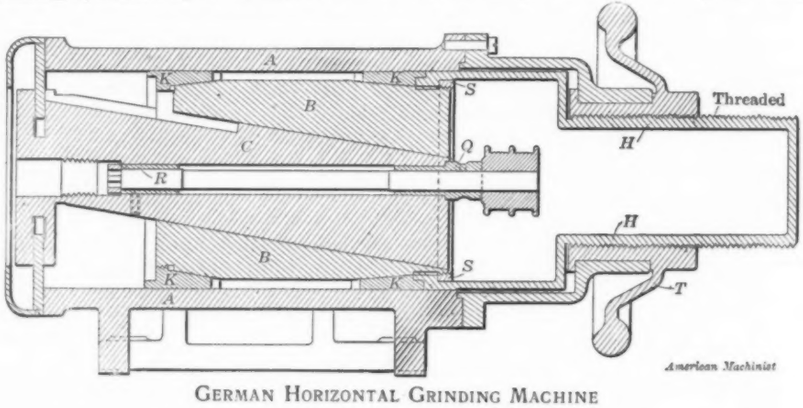
HOLDING THE SLIPPING LEAD

usual way and, as it wears away, it may be unscrewed a half or full turn, as the case may require. ULRICH STEINER.

Waynesboro, Penn.

A German Horizontal Cylinder Grinding Machine

The illustration shows the head of a German cylinder-grinding machine for grinding cylinders up to 10 inches diameter and 16 inches length. The horizontal spindle running in the bronze bushings *R* and *Q* is driven by the pulleys on the right end of the spindle. The spindle carrying the grinding wheel rotates in two bronze bearings, adjustable for wear, held in a hollow, cast-iron bar which is screwed to and centered in the cylinder *C*, and supports the grinding-wheel spindle up to the grinding wheel. This latter spindle is driven by the spindle in *C* by means of a pin in the spindle which enters the slot at the left-hand end of the horizontal shaft.



GERMAN HORIZONTAL GRINDING MACHINE

The hole in *B* is bored at an angle to the horizontal. Into this bore *C* is slidably fitted and keyed to *B*. *C* is prevented from longitudinal motion by ring *D* which fits into a slot in *C* and is screwed to the head *A*. *B* is provided with teeth and on the tapered ends two cast-iron rings *K* are held and keyed to *B*. *B* is rotated in *A* by means of a gear nest on the side of *A*.

The necessary eccentricity of the grinding spindle for grinding cylinders of any size up to 10 inches diameter is obtained by moving *B* longitudinally by means of threaded sleeve *H* and handwheel *T*. *H* is connected with *B* by means of a ring nut *S* and two halves of a ring. This allows *H* and the handwheel always to remain stationary when *B* rotates. The halves of the head *A* are bolted to a carriage.

Philadelphia, Penn. H. C. ELVERS.

A "Putting On" Tool

The piston of a large mill engine became loose on the rod, causing the closing down of the mill. An attempt was made to make temporary repairs by placing tin liners around the rod but after several failures through the tin shearing off when pressed in at the hydraulic press, one of the mechanics suggested to the mill superintendent the following which proved successful: The rod was taken to a lathe and a 2½-inch hole drilled to a depth of 12 inches, then heated to a bright red and a piece of tool steel about 3/32 inch larger driven in, causing the rod to expand large enough to allow a light cut to be taken off and the proper allowance made for the press fit. When replaced work was resumed in a comparatively short time, giving ample time to prepare a new piston and rod.

Passadena, Cal. J. E. J.

Transferring with Prussian Blue

Relative to one of the various uses of prussian blue, we used to do a job which consisted in fitting faceplates to chucks sold along with lathes, as the lathes were sometimes ordered with chucks fitted. After fitting the faceplate to the chuck, the edges of the holes in the chuck were coated with prussian

blue; the faceplate then being lightly driven in, the chuck was given a good blow over each hole with a lead hammer, which left an impression of blue of each hole on the faceplate. The plate was then drilled accordingly. This is not given out as a new scheme, as it can be and is used on similar jobs in the erection of machinery.

Detroit, Mich. DANIEL MELROSE.

The Use of Dowel Pins

Dowel pins and locating pins often appear to be such little things, but with all their smallness they are very often the cause of considerable trouble, and it is good practice to have a few well defined rules for their use, and the accompanying drawings have been made with the idea of systematizing this work.

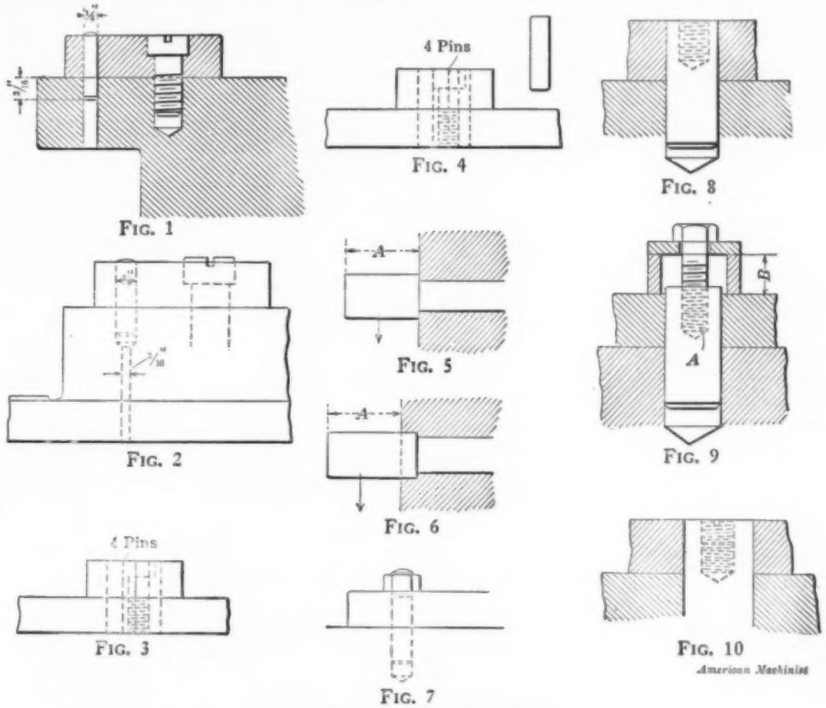


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6 FIG. 7 FIG. 8 FIG. 9 FIG. 10

THE USE OF DOWEL PINS

It is good general practice to govern the length of a dowel pin by inserting it 1½ times its diameter into the solid part, as shown in Fig. 1.

Whenever it is possible, the holes should be drilled all the way through, to allow driving out, though in many cases it will be found to be more convenient to drill a hole of the right diameter only as deep as necessary and continue with a smaller one for driving out, as in Fig. 2. I remember that at one time we had to change a small but complicated jig, and only one little dowel pin of ⅛ inch in diameter compelled us to spoil parts that we could have used again had the hole been drilled through, or if there had been some way to get the hardened pin out, but that time the little pin cost us a good day's work.

A kink worth remembering in making a side-view drawing of a number of pins which are apt to cause confusion as in Fig. 3, is to round the corners slightly, as shown in Fig. 4.

Where a locating pin is used as in Fig. 5, the strain being in the direction of the arrow and where a shoulder is necessary to keep the direct dimension *A*, it would be much stronger if countersunk, as shown in Fig. 6.

In large, rough work where removing of dowel pins by knocking them out would be rendered impossible on account of the design of the pieces in question or for other practical reasons, a dowel pin with a nut on it, as in Fig. 7, would be the thing to have, and in a case where a nut would be in the way, or is not wanted, a pin as in Fig. 8 might be used, which can be removed by using a common screw in connection with a ring and washer, as indicated in Fig. 9. The tapered hole *A* need not be very deep, and if after the dowel has been pulled out so far that the screw has reached the bottom of the tapered hole and the dowel should still stick in too tight to be pulled out with a pair of tongs or the like, the hight *B* can be increased and the screw applied again after unscrewing it enough to suit the new hight. To keep dirt out of the tapered hole it might be closed with a little screw, as in Fig. 10.

Hartford, Conn. J. C. P. BODE.

Fixing Pencil Marks on Paper

The *Revue de Mecanique* gives a couple of schemes for fixing pencil lines on paper or tracing cloth. The first of these is to rub the drawing with a piece of wax like that used in the manufacture of phonographic rolls, this producing a kind of varnish which protects the lines against rubbing.

Another process prepares the paper before the penciling, by spreading rapidly over it a solution of warm alcohol and bleached colophone so as to thoroughly wet it, after which it is to be dried in warm air. The pencil works easily on the surface, but it does not appear that a rubber can be used. To fix the lines it is necessary only to heat the paper slightly and the lines are then covered with a thin coating of transparent varnish.

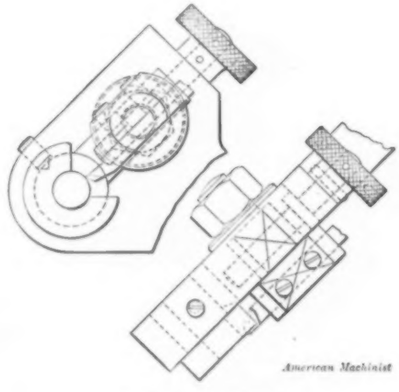
It generally happens that the desire to preserve pencil marks comes as an afterthought, but then such fixing of the lines may be of importance, if it can be done, either as matter of legal evidence or otherwise. I have often fastened pencil lines by just wetting the paper with *skimmed* milk. There should be no trace at all of cream. After the wetting a clean paper may be laid over the other and it can be gone over with a hot flat iron.

New York City. FRANK RICHARDS.

A Turning Tool

Turning long, slim spindles, on the pilots of nut taps or headless screws, is often a slow, expensive operation, if the quantity is too small to justify using a turret lathe.

The tool illustrated herewith was made for such purposes.



A TURNING TOOL

The holder is like an ordinary lathe tool with the front end bored out for a bushing held in place by a small headless set screw. Above this bushing is a slot having a tool block that can be adjusted up and down by the nurled head screw, and tightened by the nut. The cutting tool is held in place by two screws.

In use the bushing serves as a follower rest close to the tool and backing up the cut.

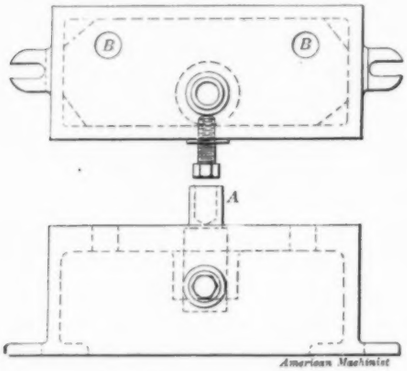
Berlin, Germany. M. BAU.

A Counterboring Jig

The rapid counterboring of drilled parts such as the ends of connecting rods, which must be faced off to a certain thickness, is easily done by using the device, shown in the sketch, consisting principally of a hardened-steel plug set into a cast-iron base which may be readily bolted to the platen of a drill press.

Plugs of various lengths and sizes may be used for different jobs, a hole being drilled in the center of each for the counterbore pilot.

In using this device, the article to be counterbored is slipped over the plug *A*



A Counterboring Jig

and the counterbore fed down as far as the hardened plug will allow it to go.

The two pins shown at *B B* are merely stop pins to prevent the work from turning.

Chips.

Workingmen's Compulsory Insurance

Theoretically every occupation should be rewarded as is capital by a return of the investment plus a reward for its use. That is, labor should be paid enough so that it could support itself and its dependents plus a reasonable profit or saving. That large numbers of workers never receive full support to say nothing of the profit is only too well known. In order to ameliorate this condition it has been proposed that the State should make insurance compulsory, thus guaranteeing labor a benefit in case of accident, sickness, early death or old age.

Employers' liability insurance is in a particularly bad favor due to the small amount of the premiums paid that ultimately reaches the pockets of the injured. Both labor and capital are mulcted, the waste being probably 75 per cent. While this comes most immediately from the pockets of the employer, it is equally certain that it ultimately is drawn from the employees.

We might say that any scheme of state insurance would ultimately be paid from the same source. That is, if the State should offer to pay for insurance for any given class of laborers it would thereby make that form of employment more attractive, thereby bringing more into it and reducing the wages paid until that particular form was no more desirable than any other. Therefore the question of state paid, or involuntary assessment paid, insurance is immaterial. The vital fact is that the cost of compulsory insurance can be made only a fraction of the cost of any insurance that an employee can otherwise get. State insurance, merely offered, will not be accepted in most cases, mainly through ignorance of its advantages. Those who need it most will not take advantage of it at all.

It may be said that compulsory insurance interferes with personal liberty, but that may equally be said of our educational system and of the tariff.

The largest wastes in insurance are the cost of selling it and the cost of collecting premiums. These would be reduced to a minimum, under state control, as all dealings would be with employers and the collections would partake of the nature of a tax, and probably be paid in the same way. Inspection of pay rolls, and keeping track of men shifting from one employment to another would probably be the largest items of cost of administration, but this would be small compared with the expenses of even the best mutual companies.

It is possible that insurance against sickness or non-employment would be inadvisable owing to the number of men who prefer a small pension and no work, to work and full pay. Malingering has been found to be one of the greatest drawbacks to this movement in Germany.

Insurance Should Be a Percentage of Income

Insurance should be made a percentage of income, both as to premium paid and benefit whether for accident, old age pension or death. This is true because men as their incomes increase, change their style of living. It should not be necessary for all men to reduce themselves to the same plane as a result of accident or termination of their insurance.

Again insurance should be made exempt from attachment and non-assignable, otherwise it may defeat its own ends. The question of the equity is a delicate one. At first sight it would appear that a man leaving one State for another should be able to collect whatever money he may have lost. That is, less whatever may have been the net cost of supporting his policy outside of administrative expense. This would only obtain in the case of old age or death benefits, accident or sickness premiums carrying no equity unless in a mutual company where the premium is intentionally set higher than the expected cost.

Looking at the matter again, however, it is evident that a man working and living in New York and finding that he had an equity of $100 in his insurance, might send his family across the river for the summer and pocket the hundred. While the money would be rightly his he would be working a hardship on his neighbor who did not care to move because every such case would increase the cost of insurance.

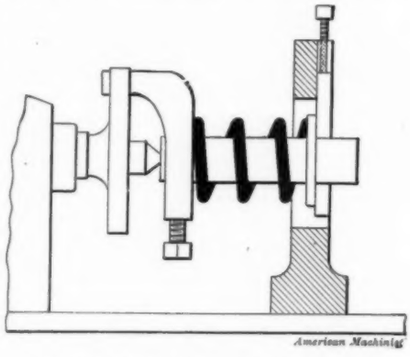
It may be said and often has been said that men ought to be thrifty enough to save without compulsion. This is true. It is also true that men do not always do as they should even in this particular.

If men had only themselves to support we might go on seeing them suffer the consequences of their own lack of thrift. The difficulty is that this lack of thrift is felt most keenly by wives and children who are in no sense to blame. The State by licensing marriages in a way assumes a responsibility which has hitherto stopped with more or less enforcement of the vows. Now it appears to be time to enforce financial provision for dependents in some form.

Fitchburg, Mass. Con Wise.

Tying Work to the Faceplate

In using the steady rest on short work supported by only one center, it is often impossible to use a clamp for lack of room and a piece of rawhide is not always as satisfactory as it might be, so



Tying Work to the Faceplate

I devised the method shown in the accompanying cut.

The spring is made of 3/16-inch wire wound about two coils to the inch for ordinary small work. One end of this spring bears against the lathe dog and the other against a washer in contact with the steady rest jaws.

This method may also be used on long work by using a piece of tubing to fill in the extra space.

Cleveland, O. A. C. Kruse.

On some classes of work, the life and cutting qualities of a disk grinder may be improved by using coarse emery or carborundum to do the cutting and a finer grade as a filler, to prevent the coarse grains from shelling off.

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American Machinist

Misconceptions of Machine Merits

Engineers have different ways of judging as to the merits of a machine. Some lay great stress on its weight, others on its speed, still others on the amount of power it can absorb; too few on the amount of work it can do regardless of all three.

One of the notions of the present moment seems to be enormous power consumption without very much regard to the useful work obtained. A machine that will absorb fifty or sixty horsepower is apt to be hailed as a wonderful development in machine design even if its actual output is but little more than a smaller machine.

There is a recent instance in which a standard machine was refused a trial in spite of the maker's guarantee that it would do the work, simply because the motor usually applied did not come up to the purchaser's idea of the proper power required for the work in hand.

The power necessary was determined by driving a piece of the same size, but of entirely different character so far as its being held was concerned, on a much larger machine. And because the large machine in question consumed considerably more power than that of the motor usually supplied with the new machine, it was turned down without a trial.

The exasperating part of the case was that the work to be done could not possibly be held so as to allow half the depth of the cut that the machine could take, while the test piece could easily be held against any cutting stress that might be put in it.

This is simply an example of the dangers of letting the mind run in any one channel too long. Power is undoubtedly a very important feature in a machine's production and weak machines have often stood as a barrier which prevented a modern output. But a machine which requires a large motor is not necessarily the largest producer as it often happens that much power is lost in the machine itself, leaving the amount actually delivered at the tool less than in the lighter machine.

This demand for excessively powerful machines is leading us astray in some cases. It is often better to lose a little time on the maximum-sized work the machine will handle, than to lose power and efficiency with all its attendant wear to the machine, on the great majority of the work done.

And after all, production per dollar of investment, maintenance and operation, and per hour of time, is the real question regardless of the power consumed, the weight of the machine or any other feature. As a leading shop manager remarked, "I never question the price per pound, the weight, size or power of a machine. If a maker in whom I have confidence guarantees a result that pays for the investment and for the operation of the machine, I would rather pay a thousand dollars a pound than one dollar, because the machine would take up that much less space in the shop. I only ask two questions, what will it do and what will it cost?"

While power consumption should be a measure of work done, it is not necessarily the case and we will do well not to condemn machines that consume less than we think they should, until we know that they cannot do the work required.

Can We Have a Science of Inventing?

The name inventor appeals to different persons in various ways. Some venerate and envy the inventor; others dream of some day having the inventor's fame, and not a few men with splendid creative, designing ability abhor the word and all it implies.

Is this contempt, on the one hand, and admiration, on the other, explained by the old saying, "Familiarity breeds contempt," or is there some other reason?

In answer, may not this mistaken idea be the reason? That inventing is supposed to be the work of a genius, instead of a job that a man can do successfully if he is properly trained for it.

If inventing can be considered a prosaic science, instead of an attribute of genius, this stigma will be at once removed, and there will be the accompanying advantage of a firm foundation upon which to build up yet greater achievements for industry and human comfort. From the dreams and deceptions of alchemy came out the modern science of chemistry. Cannot a science of inventing come out of the present chaotic conditions with their inefficiency and wasted effort?

We would not expect anyone to solve a problem in higher mathematics without a previous knowledge of mathematical science. We require a chemist to be a man with a knowledge of the fundamentals of the science that he uses. We restrain persons from practising medicine and law unless they can prove that they have had a suitable preparation for their duties.

Invention, successful invention, is thought. Goethe gives us this sentence: "What is invention? It is the end of seeking." Yet, by our actions and sayings, we imply that anyone at any time can take up this creative work and carry it on successfully.

Thousands of worthless inventions, hundreds of wasted lives, and millions of misspent money, show the fallacy of our assumption. Must this continue? Cannot we conserve our inventive resources, as well as our physical resources?

Can we not have a science of inventing based upon fundamental axiomatic principles of mechanism? Can we not lay down a synthetic method of procedure whereby a designer can easily and surely build up a mechanism to meet the conditions of his problem? We believe all this is possible.

It is not an easy science to investigate and put into words, for a painstaking analysis must be made of the thought process by which an invention is evolved.

The advantages from the use of such a science do not need to be detailed. But instead of lessening the interest of the inventor in his work it will increase it, for he will be sure of all of the steps of his reasoning and of his final result. He will make fewer mistakes and fewer false moves. His superior method of attack will permit the solving of problems now considered impossible.

An Individualist's Protest

You may determine the distance of a star by multiplying the number of seconds required for a ray of its light to travel to the earth. You may know exactly what will result when certain chemical substances are brought together. *But you can never tell precisely what a man will do under circumstances which have been familiar to the world since the beginning of time.* The element of human nature will not permit itself to be classified and cataloged. It resents every attempt to force it into the laboratory for the purpose of analysis. It objects very strenuously to being placed upon the operating table for the purpose of dissection.

There are degrees of human nature so fine that they cannot be measured by the most exact micrometer that was ever invented. To the man who would cram it into a mold it manifests its indignation by breaking the barrier that confines it. *You cannot deal with men as the entomologist deals with his millions of bugs.* They refuse to be "grouped" and they prove it by annihilating the carefully made deductions of the sociologists. Sometimes these superior beings are surprised to find that their "subjects" have forced their way into the "holy of holies," into the very social grade to which they themselves belong. No longer are they the "high priests" with peculiar privileges. Their sociological rules cannot account for it. They regard with astonishment the workingman who seems to possess powers equal to their own. With impunity have they been prodding their kid-gloved fingers into his private affairs. Without shame have they been "slumming" in the respectable tenement house district in which he makes his home, subjecting his wife and children to the humiliation of the outcast in society.

No, ye students of the working classes, *you cannot deal with them as you deal with the lower creatures and the objects of a lower order.* But brother is an open sesame to every heart, even though each heart may have a beat all its own.

New Publications

Inventors and Inventions. By H. Robinson, 41 West Thirty-third street, New York City. Price, 25 cents.

This is an unusual publication, designed to awaken the public conscience as to the great injustice continually being done to inventors, and at the same time containing many suggestions for the inventor in the way of financing, marketing, selling, manufacturing and other phases of the problem.

It is profusely illustrated, largely by cartoons, some of which are very suggestive, others being decidedly commonplace. There are 31 short chapters, many of which are on subjects very important to the inventor, and there seems to be much good advice scattered throughout the book.

Principles of Machine Work. By Robert H. Smith. 375 pages, 5x8 inches, 434 illustrations. Published by the Educational Book Company, Boston, Mass. Price, $3.

The second of the series of practical books, the first of which was recently reviewed. It makes clear the principles or elements underlying the handling of a large variety of shop work. It is impossible to even mention the points that are taken up, as all of the 434 illustrations have a direct bearing on the work, and the way in which it is done.

The book differs from many in that it gives the exact procedure to be followed in doing the work instead of generalizing as is apt to be done. In fact, nearly all operations are scheduled just as we find them in shops where system and time study has had full play, with the sole exception of the time limit.

There are 25 years of experience in teaching shop work behind this book, besides the time previously spent in manufacturing, and we believe that many will find this a decided help either in learning or in teaching.

Its method of treatment is distinctly satisfying and as a work of reference it should be well received.

Personals

H. A. Stillwell, of the Charles Churchill Company, Birmingham, England, has returned home, after a several weeks' stay in this country.

J. L. Straub, secretary of the J. S. Bretz Company, New York, sailed on April 25 to visit the European plants which produce the goods his company markets here.

H. K. English, who until recently was a member of the engineering staff of the General Electric Company, Schenectady, N. Y., has become secretary of the Ottumwa Iron Works, Iowa.

Walter C. Brown, who until recently conducted a consulting-engineering practice in Montreal, Canada, has been appointed chief engineer of the newly organized Humphrey Gas Pump Company, Syracuse, N. Y.

Henry R. Cobleigh has resigned as mechanical editor of *The Iron Age*, which position he has held for the last seven years, to take charge of the advertising and publicity of the International Steam Pump Company, New York City.

Ralph D. Van Valkenburg, formerly sales agent for the Taylor Iron and Steel Company, has been appointed district manager of the Chicago office of the Colonial Steel Company, succeeding Frank C. Lewis, recently resigned.

Edward Blake, Jr., formerly manager sales department Wells Brothers Company, Greenfield, Mass., and recently treasurer Canadian Tap and Die Company, Galt, Ontario, has resigned to assume the position of general manager of the J. T. Slocomb Company, Providence, R. I.

F. A. Halsey, editor of the American Machinist, has resigned on account of his health. Mr. Halsey will retain a desk in the office and undertake such editorial work as he cares to, but the regular duties of editor-in-chief will be taken up by L. P. Alford, who has long been assistant editor.

Alexander E. Brown

Alexander E. Brown, president and general manager of the Brown Hoisting and Conveying Machine Company, Cleveland, Ohio, died on April 26, after a few months' illness.

Mr. Brown was born in Cleveland in 1852, and after completing a common-school education in that city, he took up an engineering course at the Brooklyn Polytechnic Institute. Shortly after his graduation from that institution he engaged in surveying work for a brief period and then became identified with the bridge-building industry, in course of which work he laid the foundation upon which he developed many of the important hoisting and conveying machines of his invention.

Shop Equipment News

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

Disk Grinding Machine

The machine illustrated herewith is especially adapted to the grinding of thrust washers, piston rings, disks, saws, dies, collars and work of a similar character.

The wheel head is mounted on a heavy sliding table, having automatic traverse. The rotary magnetic or other chuck for holding the work is threaded onto a horizontal spindle, the spindle head being carried on the cross slide. A friction clutch on the work spindle is controlled by the lever at the side of the head, and is used in connection with the knob in the center of the traverse hand wheel, which stops the wheel traverse, allows the work to be placed in position or removed without stopping any part of the counter shaft.

DISK-GRINDING MACHINE

The traverse of the table is automatic in either direction. The table can be run beyond the reversing point without losing the adjustment of the dogs. Three changes of travel are provided for any work speed. A diamond tool holder is attached to the side of the work head, allowing the wheel to be trued without removing the work.

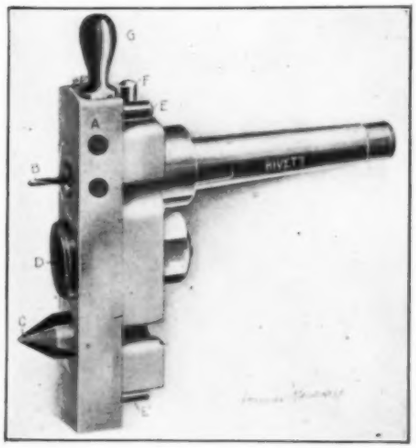
The work spindle is driven by a friction-clutch pulley and has five changes of speed. The work head is graduated to read to 30 degrees either side of center, allowing conical or concave pieces to be ground.

An automatic cross feed can be furnished when desired. The machine is furnished either with or without a pump.

The spindle takes wheels up to 8 inches in diameter, ½ inch thick, with 3-inch hole, and the machine has a capacity for work 12 inches diameter, 2 inches thick. It is a recent product of the Naragansett Machine Company, Providence, R. I.

A Tailstock Centering Attachment

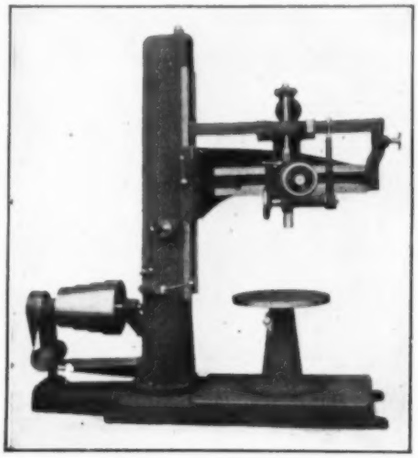
The halftone shows a new centering attachment made by the Rivett Lathe Manufacturing Company, Brighton, Boston, Mass. The body of the attachment carries the swinging member *A*, in which are mounted the drill *B* and the countersink *C*. *A* swings on the pivot bolt *D*. With the stop *E* on *A* against the front of the stop *F* on the body, the drill *B* is concentric with the spindle. If *A* be swung so that the stop *E'* is against the back of the stop *F* on the body, then the countersink *C* is concentric with the spindle. *G* is a small handle for swinging *A*.



RIVETT TAILSTOCK CENTERING ATTACHMENT

Sensitive Radial Drill

This machine is designed especially for driving high-speed twist drills from ¼ inch to 1 inch, inclusive. It is belt driven throughout without a gear in the transmission; it is, therefore, practically noiseless even at the highest speeds. This machine has driven a ½-inch high-speed twist drill at 900 revolutions per minute through a 2-inch cast-iron plate at the rate of 25 inches per minute under a feed of 0.028 inch per revolution of the spindle, and other size drills in proportion.



SENSITIVE RADIAL DRILL

A two-speed friction countershaft and four-step cone furnish eight spindle speeds in geometrical progression from 300 to 1170 revolutions per minute, giving an average velocity of 80 feet per minute for drills ranging by 16ths from ¼ inch to ¾ inch, inclusive, and by 8ths from ½ inch to 1 inch, inclusive, and where desired the countershaft can be speeded up to give the highest speeds that high-speed twist drills will stand.

The belt running into the base of the column transmits the power from the cone pulley shaft to a shaft that extends the full length of the column. A pulley on this vertical shaft carried by a bracket extending into the column from the radial arm, and driven from the shaft through a spline and feather, transmits the power

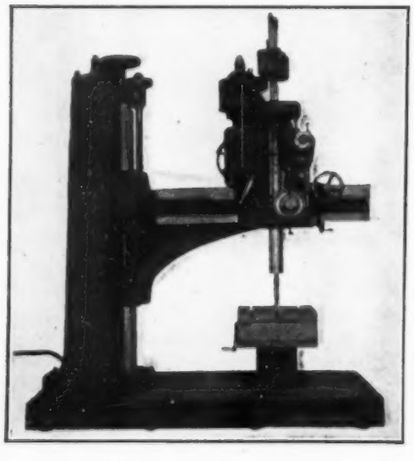
by a horizontal belt to the spindle. This belt is arranged in such a manner that while the belt encircles half the circumference of the spindle pulley at all times, the same tension is maintained in the belt irrespective of the position of the head without resorting to springs or counterweights, but is due entirely to the position of the idler pulleys. These idler pulleys are so placed with reference to the spindle pulley that the driving belt has an equal contact on both sides of the spindle pulley exerting a balanced pull, and producing no side strain.

The spindle is rapidly brought to the work by the hand wheel at the left of the head, and fed into the work by the lever shown at the right. This lever is provided with a ratchet so that a convenient position for drilling can always be maintained, and when thrown to the vertical position, a latch automatically locks it and prevents it from falling, but does not release the spindle from the control of the lever.

This machine is also furnished with a tapping attachment. Like the drive of the machine proper, not a gear is used in connection with this attachment, the spindle being reversed by a narrow belt. The machine will pull up to and including ¾-inch United States Standard tap. It is a recent product of the William E. Gang Company, Cincinnati, Ohio.

New Radial Drill

This machine, designed and constructed by the James Clark, Jr., Electric Company, Louisville, Ky., will drill in the center of 12 feet with maximum distance of 72 inches between spindle and



NEW RADIAL DRILL

base. The spindle has a vertical traverse of 19 inches and the smallest diameter is 3 inches. The motor driving the spindle is of the variable-speed type, 4 to 1 speed variation, and will develop a maximum of 15 horsepower. Twenty spindle speeds are obtained through one back gear and the motor changes. All the driving and feed gears are of steel. The friction back gears can be changed without stopping. All the operating handles are within easy reach of the operator without changing his position.

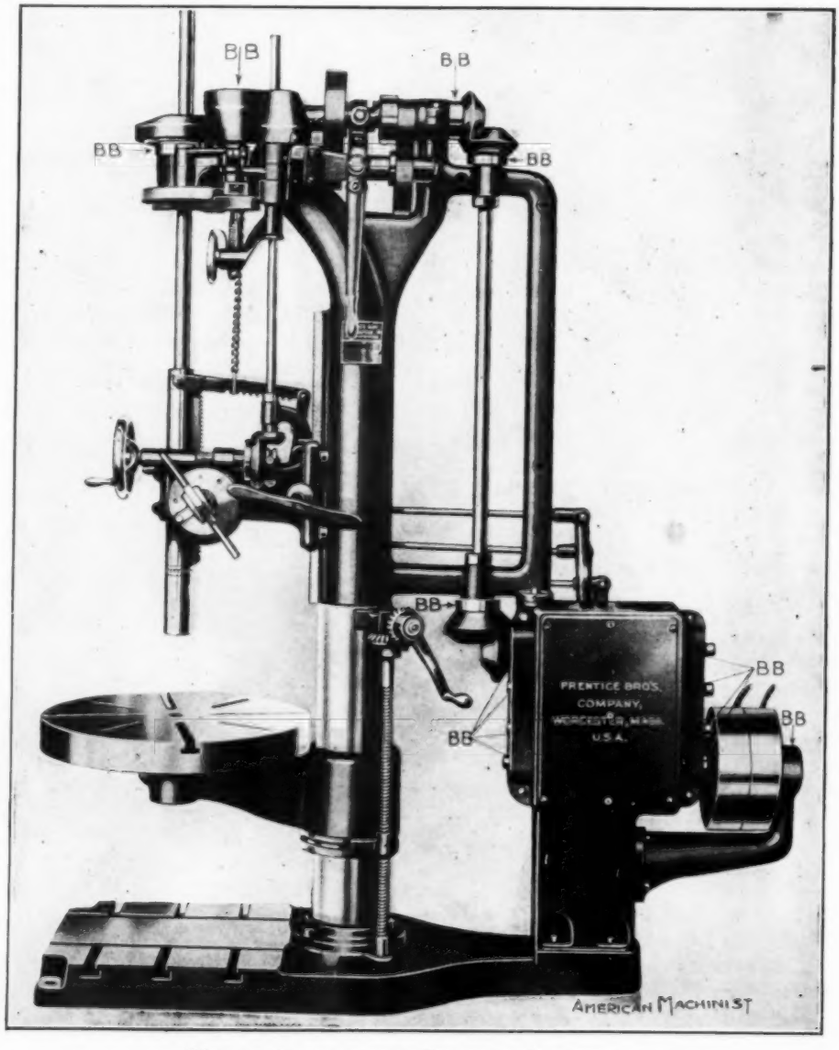
The hoist motor for the arm is mounted on top of the column and the motions up and down are obtained by throwing the controller handle shown on side of column either to the right or left. The column swings on ball and roller bearings, and when the clamping lever is thrown, the large flange at the base of the column is drawn down into intimate contact with the bed, resulting in rigidity. The arm is gibbed to the column with long bearing surfaces. While testing the drill 35 holes were drilled with 1⅞-inch high-speed drill in 25 minutes through two steel condenser heads clamped together, the total thickness of which was 2 inches. The actual drilling time for each hole was 35 seconds.

The bed measures 117x54 inches, the total hight of the machine is 114 inches and it weighs 19,000 pounds.

Ball Bearing Drilling Machine

Prentice Brothers Company, Worcester, Mass., have brought out a 26-inch drill, in which ball bearings of their own design replace the plain bearings generally used. The location of these bearings can be seen from the illustration, which covers all the important points on the machine. These bearings are of the four-point type, the outer race being in halves so as to be easily adjusted to distribute the load at all times. This type of bearing is used because it combines the radial and thrust features, and has advantages in applications such as these. The bearings are made in their own shop, using alloy steel in the races and balls, so as to secure the best results. Each bearing is provided with a oil cup to insure lubrication.

The general design and the capacity of the machine remain the same, but tests have shown a considerable saving in power consumption over the plain-bearing machine. Such tests indicate that



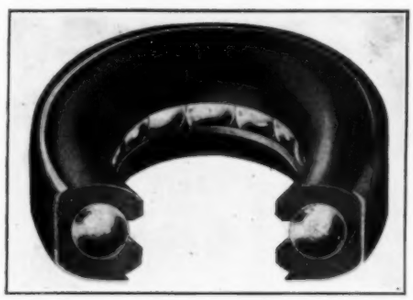
26-INCH BALL-BEARING DRILLING MACHINE

these machines consume about one-half the power of the plain-bearing machine of the same size and type, under severe load. It also appears that the ball-thrust bearing of the spindle is responsible for about half of this saving, the rest being due to the other bearings. It is also believed that this will add to the life of gears, owing to the alinement being maintained more accurately than in a plain bearing.

"Nice" Thrust Ball Bearing

These bearings, made by the Pressed Steel Manufacturing Company, Philadelphia, Penn., are shaped in dies instead of being turned.

The material used in their construction is the same as is used in the all-turned



THRUST BALL BEARING

thrust bearings, and a similar hardening process is followed.

This type of bearing has been largely applied to motor and engine service.

Automatic Tapping Machine

The illustrations herewith show a 4-way tapping machine, part of a line of Evans' automatic independent reaming and tapping machines built by the Beaman & Smith Company, Providence, R. I. This type of machine is also made for bushings, unions and valves.

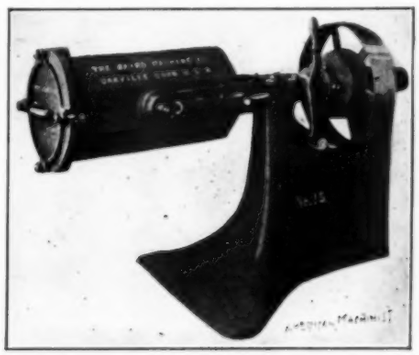
The machine is usually furnished with three heads to cut ells, tees and y's. It is provided with a toggle-joint chuck which grips the fitting rigidly and is a floating chuck in order to allow the taps to center themselves in the rough cast holes. The chuck is mounted like a shaper table, with vertical and horizontal adjustments; this horizontal adjustment allows the machine to tap return-bends, which usually takes a special machine.

On these machines any head can be shifted to any angle, so that any degree ell or tee can be cut, also each spindle has a separate leader, which can be instantly removed, allowing any pitch to be cut with any head; this leader can be adjusted so that a fitting can be gaged to a quarter of a turn. The chucking is done with a single motion of each hand, and while chucking an automatic lock prevents the foot lever from working. In addition to this safety device, all movable parts, gears and clutches are guarded by cast-iron guards. The machines have a quick return, reversing three times as fast as they tap. A special feature is that the number of revolutions used to tap a fitting can be changed to suit the length of thread to be tapped.

On the machine illustrated the output for 10 hours is 1030 pieces.

Single Ball Burnishing Barrel

The single ball-burnishing barrel shown in the illustration has friction-clutch drive, tiltable barrels, brass cover, wood-lined barrel, etc., similar to those of the double type. The friction-clutch pulley allows the machine to be belted direct to the main shaft and either parallel or at right angles to it.



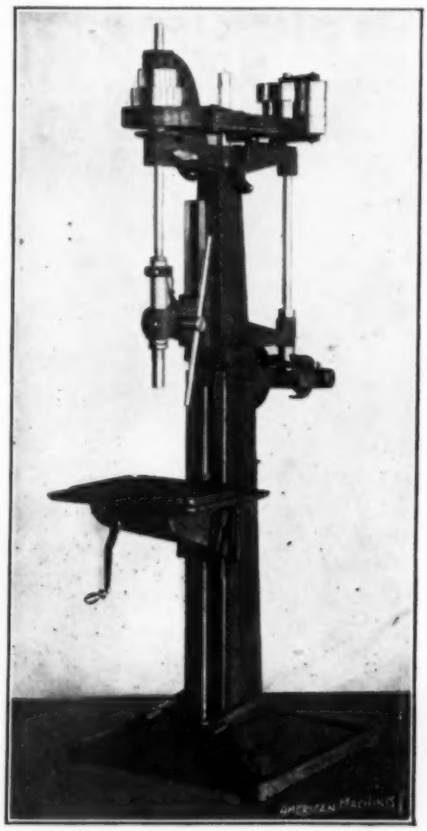
SINGLE BALL-BURNISHING BARRELL

This machine is especially adaptable for experimental and special work, or where quantities make unnecessary a double-type machine. It is made in two sizes by the Baird Machine Company, Oakville, Conn.

High Speed Sensitive Drill

Rigidity and central control are two of the main considerations in the construction of the drill illustrated herewith.

The cone belts are shifted mechanically by a lever on the right of the machine by which any speed is instantly obtained.



HIGH-SPEED DRILL

The belt tightener is arranged to swivel about the back vertical shaft and besides increasing the tension of the belt also increases the lap with a corresponding increase of power; this tightener is operated by a handwheel through a rack and pinion on the left side of the machine and is interlocked with the belt-shifter device, the initial movement of the shifter releasing the belt tightener, making it unnecessary to shift a tight belt. A special endless belt is furnished for each spindle.

At the base of the machine are two pedals, one on either side of the column on either of which a slight pressure starts and stops the machine.

This machine, in a test with a 1-inch

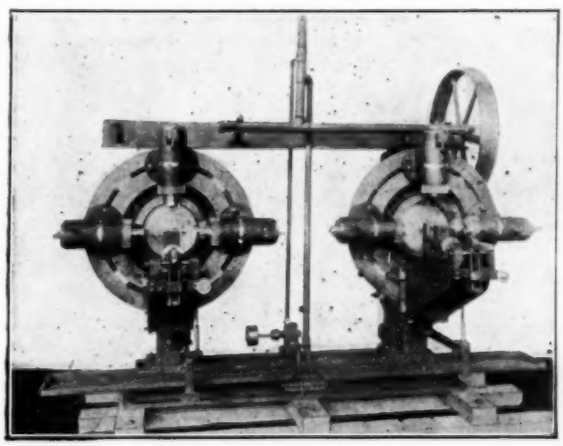


FIG. 1 AUTOMATIC TAPPING MACHINE

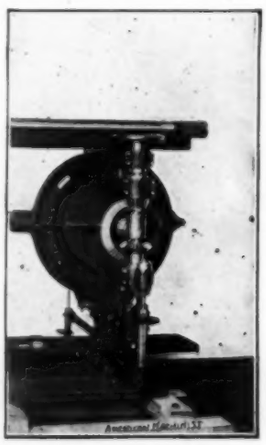


FIG. 2

drill, went through one inch of cast iron in 8 seconds.

The table-tightening handles, the elevating crank, the cone-belt shifter, the belt tightener, and the line-belt shifter, are all operated from the front of the machine.

These machines are designed to stand extremely high speed and moving shafts run in bronze boxes of large area and are interchangeable.

The spindle is bored to Morse taper No. 3 to accommodate drills to the full capacity of the machine. The spindle cone has a heavy top support relieving the spindle of strain. All shafts are turned and ground.

These machines will be built with one to four spindles, and to illustrate their rigidity the single-spindle machine weighs about 480 pounds. They are built by the Francis Reed Company, Worcester, Mass.

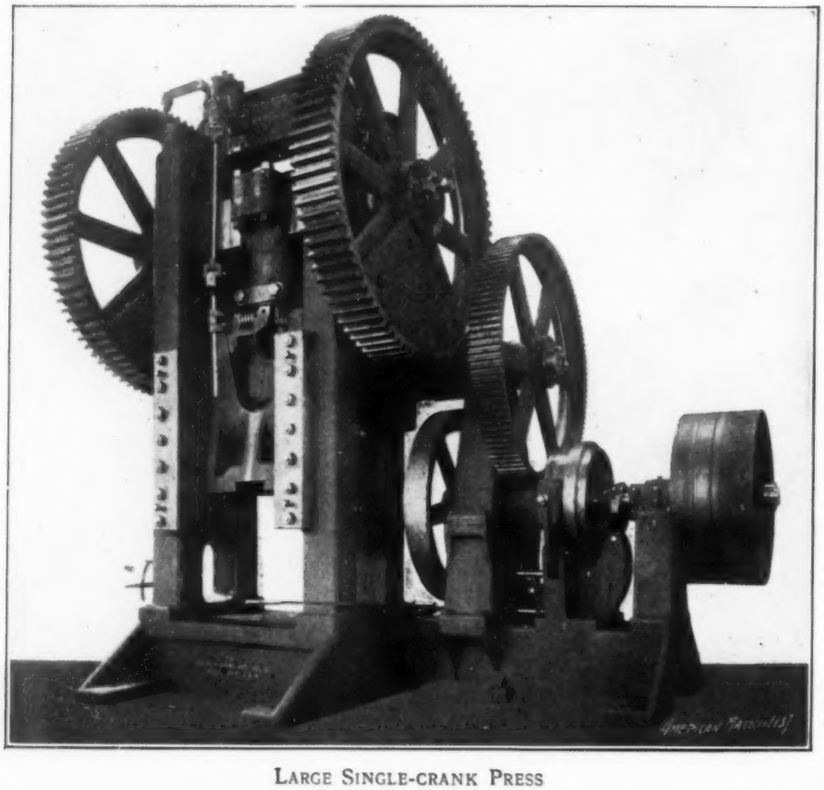
Large Single Crank Press

The single-crank belt-driven press shown herewith is of particular interest, so far as size and weight are concerned. The press is intended for use in manufacturing of heavy steel products and is capable of exerting a pressure of 2000 tons.

The press is operated by a large and powerful friction clutch attached to a shaft running in pedestal bearings mounted on a machined bed extension which is securely and accurately fitted, doweled and bolted to the main frame of press, this construction maintaining alinement of shafts for pinions and gears.

The press is double back geared with a proportion of gearing of 54 to 1. The second or larger back shaft, to which are attached the two steel pinions engaging with the two larger or main twin gears, is large enough to prevent any possibility of torsion between the two main gears mentioned. The main frame of the press proper is reinforced by four large steel rods 8½ inches diameter.

The machine weighs, complete, 275,000 pounds, is 23 feet high, has a width between housing and bed area of 60x60 inches, and a stroke or slide motion of 18 inches. It was designed and built by the Toledo Machine and Tool Company, Toledo, O.

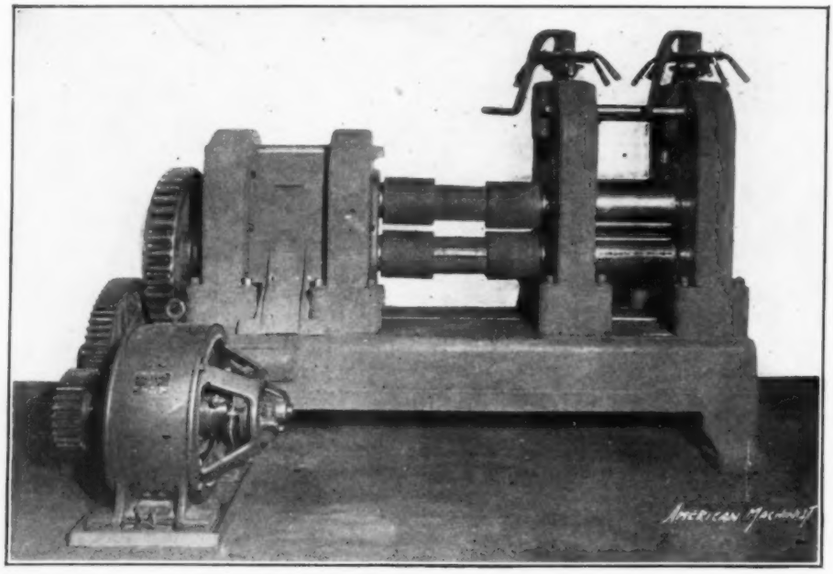


LARGE SINGLE-CRANK PRESS

Standard Rolling Mill

The new type of rolling mill shown in the accompanying halftone, direct connected to the motor, has recently been developed by the Standard Machinery Company, Providence, R. I.

The machine has regular square section roll housings, fitted with rolls 12 inches diameter, 20 inches face; heavy phosphor-bronze bearings on the roll journals, with crucible-steel adjusting screw. The upper boxes are supported by side yokes which straddle the adjusting screws and which are connected to the boxes by straight rods for lifting purposes. On the top of each upper box is a hardened and ground tool-steel thrust washer to take the thrust of the screw. The outboard or roll housing is set on the bed with T-bolts and T-slots in bed, allowing the use of different length rolls, the housings sliding in and out. The maximum length roll that can be used is 22 inches, whereas the minimum length is 10 inches face, 12 inches diameter. The rolls are driven by cast-steel wabblers and cast-steel wabbler couplings direct connected to the herringbone pinion shafts which are in the gear housing. A special feature of the gear housings is the use of herringbone pinions. These herringbones are 13 inches pitch diameter, 14 inches face; pinion being 7 inches face and being made right and left. The pitch of these pinions is 2, and they are made of forged steel, and all teeth are cut, making an accurate and uniform drive to transmit to the rolls.



STANDARD ROLLING MILL.

The total weight of this machine, including bed plate with motor, is 27,500 pounds and it is made in various styles, both with single and double housings. The machine is fitted either with friction-clutch drive, chain drive or direct gear drive.

Heavy Duty Crank Shaft Lathe

The accompanying photograph illustrates an improved form of lathe for the rough turning of automobile and gas-engine crank-shaft pins. It is equipped with special adjustable headstock and tailstock fixtures designed to take cranks up to about six-inch stroke, a special heavy carriage carrying a three-tool turret tool post with individual cross stop for each tool, roller steady rest, automatic stops for longitudinal feed, pan bed and pump for cutting lubricant.

The headstock fixture is carried on a large faceplate on spindle and so arranged as to be adjustable for different throws. This slide carrying the revolving fixture is gibbed to faceplate and held by four T-slot bolts when proper setting for throw has been made. A graduated scale and adjusting screw permit accurate adjustment. The revolving fixture is accurately indexed by a hardened-steel plunger carried in slide entering hardened-steel bushes in fixture. The index is so divided that the fixture may be swung through 120 or 180 degrees, making it adaptable for 2-, 4- and 6-throw cranks.

After indexing, the fixture is clamped by two T-slot bolts held in circular T-slot. The revolving fixture is equipped with removable split bushes so that different bushes may be used for different diameter of line bearings on crank-shaft. A V-shaped dovetail piece with hand nut adjustment is brought into position and centers the pin by the cheek and at the same time acts as a driver. The crank is clamped in position by the hinged clamp on fixture.

The tailstock fixture is also adjustable and carried on a spindle revolving in bushes in the tailstock barrel. The adjustment is taken care of in the same manner as on the headstock fixture. This fixture also carries removable split bushings and a hinged clamp.

The tool equipment on this machine is somewhat of a departure in crank-shaft lathe construction, and is shown in Fig. 2.

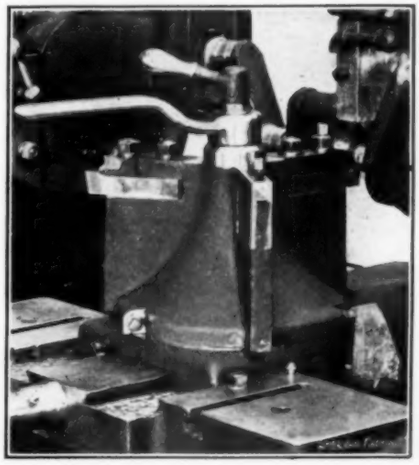


FIG. 2. THREE-TOOL TURRET TOOL BLOCK

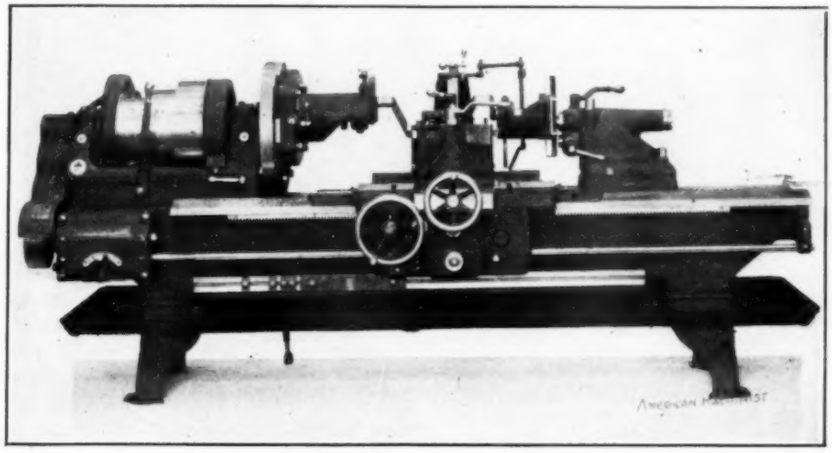


FIG. 1. LE BLOND HEAVY-DUTY CRANK-SHAFT LATHE

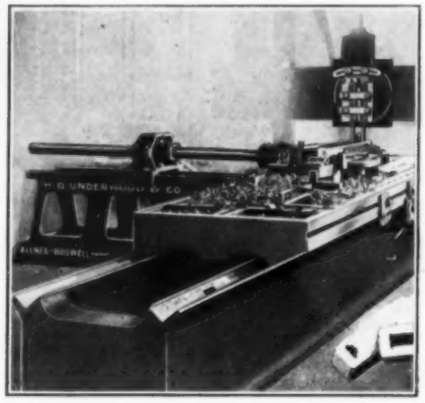
All the tools on this machine are carried in the three-tool turret tool block. This not only gives a substantial tool support when turning but in doing the heavy filleting operation, all the stress is directly downward on the shears of the lathe.

The lathe has the new form of compensating V with apron of single-casting box-shape type and feed box with sliding gears giving eight changes of feed. All the gears in the apron and feed box are of steel. The machine may be furnished with either three-step cone and double-friction back gear or with single-pulley drive head, and is a recent product of the R. K. Le Blond Machine Tool Company, Cincinnati, O.

Radius Planer Attachment

The radius attachment shown in the accompanying halftone, and known as the Allner-Boswell radius attachment, is a recent product of H. B. Underwood & Co., Philadelphia, Penn.

In it a square block which is integral with the bottom plate, that is fixed to the planer table, transmits the driving power to the top plate always in the direction of the reciprocating movement without giving a resulting force with the tool resistance, other than parallel to it. The oscillating component of the mechanism is produced by an enlarged pin that surrounds the square block kept down by a cover plate. An enlarged eye engages around the pin and with a retaining ring forms on its top side the



RADIUS PLANING ATTACHMENT

setting table. For setting up, the link is lined up to a center line marked on the chuck.

Owing to the very small amount of stress the radial bar is a tube and being comparatively light is easily handled. It permits of adjustment to radii of different lengths by means of a guide that is double-pivoted in a post sliding on a foot plate perpendicular to the planer direction. This radius attachment allows very strong cuts and stands up to the limit of the machine tool without injury. After the link has been planed, milled around the edges, the end clearances drilled and slotted, it is set up on the chuck table and the center block removed by parting with two tools simultaneously. This parting operation, including setting-up link and lifting-out block after parting has been done on a 15-horsepower planer in 35 minutes, the link of hammered steel 3½ inches deep. The attachment is in use, not only on links, but also on dies, quadrants, curved stone, etc.

The Collinwood Link Grinder

EDITORIAL CORRESPONDENCE

A new link grinder was recently completed at the shop of the Lake Shore & Michigan Southern Railroad, Collinwood, Ohio, that has some features not found on machines used elsewhere for the same purpose.

Fig. 1 gives a view of the principal working parts of the machine. *A* is the radial link carrier; *B B B B*, the adjusting screws for holding the link to be ground in place; *C*, the grinding wheel; *D*, the pivoted bracket on which the bar *E* and the link carrier swing; *F*, locking bolts which clamp the bar; *G G*, thumb screws for fine adjustment while grinding; *H*, the grinding-wheel driving belt; *I*, grinding-wheel driving pulley; *J*, grinding-wheel belt-idler pulley; *K*, belt for driving, feeding and grinding wheel vertical-motion mechanism; *L*, reverse rod; *M*, reverse hand lever; *N N*, reversing stops; *O O*, reverse-rod guide brackets; *P*, the bracket which carries the nut running on a lead screw under cover *R*, which gives the link carrier its movement and under the cover *S* is the screw-reversing mechanism.

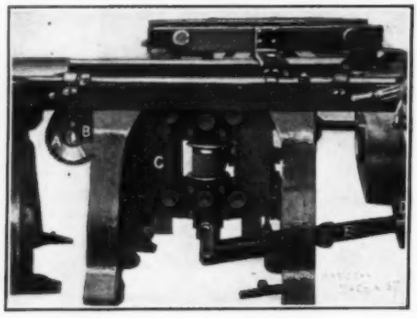


FIG. 3. FRONT VIEW SHOWING VERTICAL SPINDLE MOVEMENT

In grinding a link it is first set into the carrier and adjusted according to the shape of the slot, with the thumb screws; then the carrier is adjusted for the proper radius; next the stops are set to give the right length of stroke and then the motor is started and the necessary feeding onto the grinding wheel done with the thumb screws on the pivot block.

A back view of the machine showing the position of the motor at *A* is given in Fig. 2. As the link carrier moves back and forth in its grinding movement, the grinding wheel moves up and down, so as to wear evenly, the motion being given by a worm wheel driven by a worm on the pulley shaft of the feed drive. This worm wheel *A*, Fig. 3, moves a lever *B*, which gives the bracket *C*, carrying the grinder spindle the motion described. The weight of the bracket *C* and its fittings is counterbalanced by the weight *D* through the lever *E*.

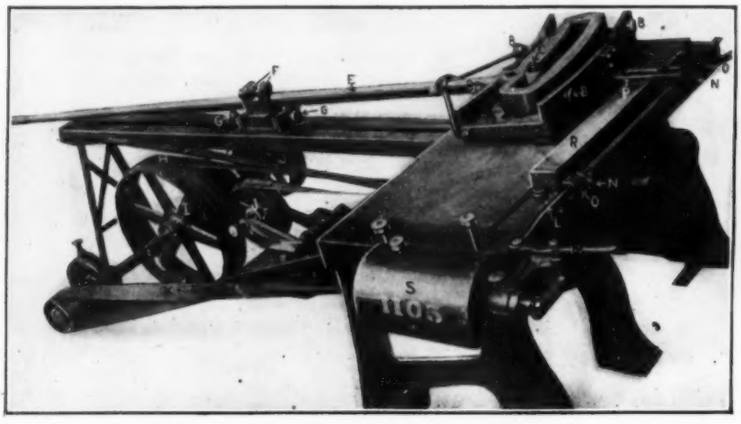


FIG. 1. GENERAL VIEW OF COLLINWOOD LOCOMOTIVE LINK GRINDER

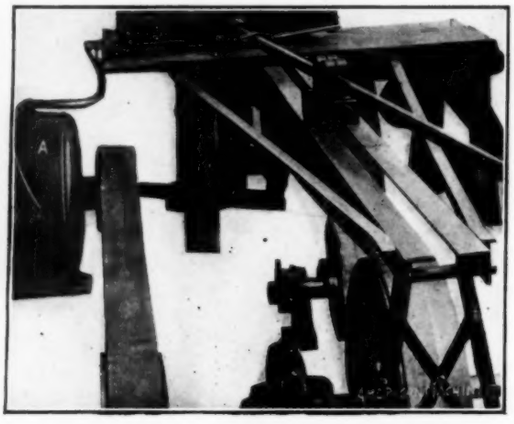


FIG. 2. REAR VIEW, SHOWING POSITION OF MOTOR

Fig. 4 gives the details of the machine, which will make clear any point not apparent from the foregoing halftones and description.

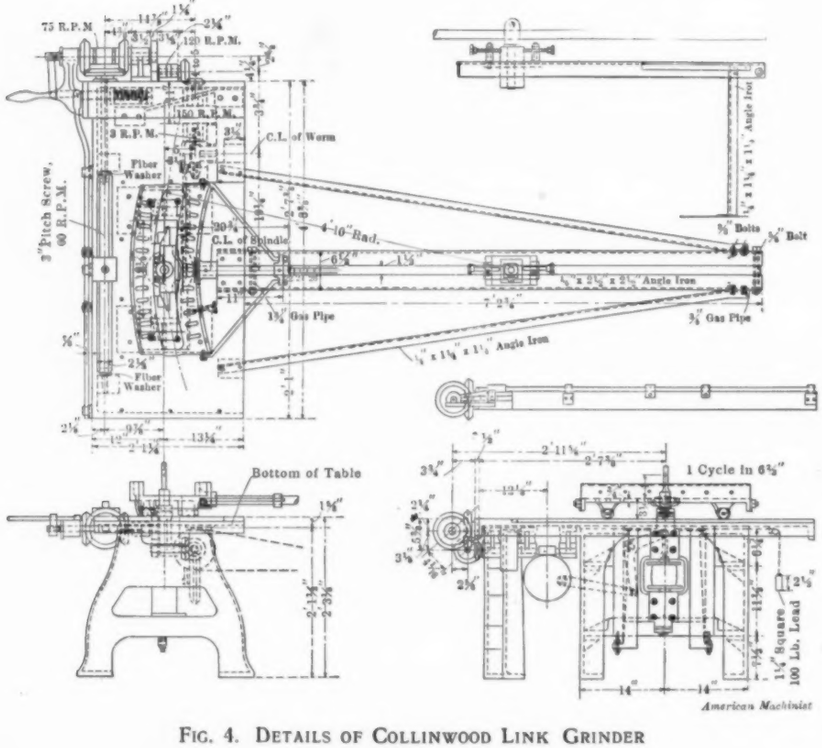


FIG. 4. DETAILS OF COLLINWOOD LINK GRINDER

When cutting pipe threads in a lathe it is sometimes difficult to get the exact diameter necessary. When a mistake is made and the threads on a 6-inch pipe are cut a trifle too small, so that it screws right up to the shoulder, then it remains for the workman to get out of the trouble the best way he can. A very good way is to use wire cloth of the brass variety, about 60 or 80 meshes to the inch. Wrap a bit of wire cloth around the pipe, daub it with litharge or red lead and screw the pipe home with the wire cloth in the joint. This joint will never leak or come loose.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

Meriden, Conn., will make improvements in its water system.

Rochester, N. H., will build a new municipal electric-light plant.

The Pyipscot Paper Company will build a new mill at Topsham, Me.

Webster, Mass., contemplates installing a municipal electric-lighting plant.

H. J. Perkins, of Springfield, Mass., will build a new cold-storage building.

Watson & Newell, jewelers and silversmiths, Attleboro, Mass., will make large addition to their factory.

The Westerly Jewelry Company, which recently moved to West Mystic, Conn., is to erect a one-story factory.

The American Optical Company, Southbridge, Mass., contemplates a branch plant at Providence, R. I., for the making of dies.

Roundhouse and repair shop of the New York, New Haven & Hartford Railroad at Danbury, Conn., were destroyed by fire. Loss about $50,000.

The D. F. Briggs & Co., and Bates & Bacon, of Attleboro, Mass., have formed a copartnership for the manufacture of plated wire and flat stock. The new concern is known as the Union Plate and Wire Company.

MIDDLE STATES

J. Elkish is having a garage built at 1437 Vine street, Philadelphia, Penn.

The Stedman Foundry and Machine Works, Aurora, Ind., will build a new plant.

The Cleveland (Ohio) Foundry Company is making a large addition to its plant.

The Motor Repair Company, Richfield Park, N. J., will build an addition to its plant.

E. S. Hyde will erect a two-story garage at 5918 Drexel road, Philadelphia, Penn.

The Pere Marquette Railroad will erect a $30,000 roundhouse at Port Huron, Mich.

Myles Higgins is having a garage built at 580 East Sedgwick avenue, Philadelphia, Penn.

The Boyer-Campbell Company, Detroit, Mich., machinists, are erecting a six-story building.

Beutel Brothers, of Sheboygan, Wis., will erect a four-story plant to manufacture automobiles.

A two-story garage will be built at 3216 North Sixteenth street, Philadelphia, Penn., for H. C. Benry.

A permit has been issued to the Hydraulic Pressed Steel Company, Cleveland, O., for a foundry building.

Fire destroyed the foundry of the Excelsior Foundry Company, Bay City, Mich. Loss about $15,000.

The Buffalo (N. Y.) Machinery Company, building jewelers' machinery, will erect a new $15,000 factory.

The National Machine Company will erect a $10,000 machine shop at 660-662 Washington street, Milwaukee, Wis.

Bids will be received soon by Cornell University, Ithaca, N. Y., for erection of machine shop and carpenter shop.

The Board of Education, Yonkers, N. Y., will receive bids May 30 for machine tools for the Saunders Trade School.

The Ziegler-Schryer Manufacturing Company, Freeport, Ill., has commenced the erection of a new machine-shop building.

Permits have been issued to George H. Gynn, 3353 Independence road, Cleveland, O., for a machine shop and boiler house.

A permit has been issued to Gaffney & Co., contractors, Philadelphia, Penn., to build a one-story garage at 1437 Vine street.

The Keighley Company, Vineland, N. J., will build a large plant and power house. Will manufacture all kinds of shoe machinery.

Divine Brothers Company, Utica, N. Y., making water motors and buffing wheels, has taken out a permit to erect a $14,000 building.

The Hamilton Castor Manufacturing Company, Hamilton, O., has increased its capital from $10,000 to $30,000. Improvements will be installed.

The Wells-Mills Electric Company, Connellsville, Penn., is building an addition to be equipped as a machine shop. Is also erecting a garage.

The Duryea Motor Car Company, of Reading, Penn., will go to Port Huron, Mich. Will occupy the shops vacated by the Grand Trunk Railway.

Thomas F. Condon & Co., manufacturers of soap machinery and wrapping machines, are equipping a new machine shop in the Bush Terminal, Brooklyn, N. Y.

The Augustine Automatic Rotary Engine Company is to build a three-story and a two-story addition to its plant at 1862-1880 Elmwood avenue, Buffalo, N. Y.

The American Roller Screen and Stamping Company will establish a manufacturing plant at Greenfield, Ind. The company will employ 50 men at the beginning.

The Clark Airship Company, Cleveland, O., has been incorporated for $10,000 to build airships. Incorporators, William H. Clark, J. H. Levy, J. A. Bommhardt, etc.

Smith & Johnson Manufacturing Company, Cincinnati, O., has been organized to manufacture all kinds of machinery by John A. Smith, Albert F. Johnson, etc. Capital, $15,000.

The Fire Retainer Heating Company, Dayton, O., has been formed to manufacture and sell ranges and furnaces by Theodore D. Friend, Thomas J. McCormick, Alfred McCray, etc.

The International Saw and Tool Company, of Columbus, O., organized a year ago with a capital of $50,000 to manufacture a patented inserted tooth for saws, is arranging to enlarge its business.

The Cleveland Bailing Press Company, Cleveland, O., has been incorporated to manufacture and sell hay presses. Incorporators, Allen S. Wood, Joseph E. Wood, A. W. Seitz, etc. Capital, $10,000.

The Ray-Kuhn Company, Toledo, O., has been organized, to manufacture and job automobiles and supplies. Incorporators, J. Paul Ray, D. S. Kuhn, Herman F. Wither, etc. Capital, $25,000.

The Shoemaker Manufacturing Company, Trenton, N. J., has been incorporated to manufacture metal goods, novelties, etc. Capital $125,000. Incorporators, W. E. Rue, I. M. Green, M. E. T. Green.

The Price Auto Works, Chicago, Ill., has been incorporated with $20,000 capital to manufacture auto trucks, automobiles, machinery, etc. Incorporators, Arthur C. Price, L. E. Price, George Walker.

The Garford Company, of Elyria, O., manufacturers of automobiles and auto trucks, has increased its capital stock from $650,000 to $2,000,000. The addition being built to its plant will soon be completed.

The Rochester (N. Y.) Motor Fire Pump Company has been incorporated with $150,000 capital to manufacture a patented pump. Incorporators, R. S. McMahon, Leonhard Fuchs, Dr. James T. McGovern, etc.

The Cleveland Utilities Company, Cleveland, O., has been organized with a capital of $10,000, to manufacture and sell electrical apparatus and equipment by A. L. Oppenheimer, K. W. Caldwell, Edward Younger, etc.

The Westman Motor Truck Company, Cleveland, O., has been organized with a capital of $200,000 to manufacture and sell motor trucks and accessories. Incorporators, George A. Weisman, L. A. Westman, C. E. Jennings, etc.

The National Automatic Machine Company, Wellston, O., has been incorporated with $100,000 capital to manufacture and sell all kinds of machinery, including vending machines, by J. C. Clutzs, J. H. Browne, George C. Sellers, S. M. Kelly, etc.

The Cleveland Storage Battery Company, Cleveland, O., has been incorporated with $10,000 capital, to manufacture and sell storage batteries and rebuild electric automobiles, by Herbert H. Jones, H. G. W. Stoltzenberg, B. L. Jones, etc.

The United States Machine and Tool Expert Company, Cincinnati, O., has been formed to engage in the business of manufacturing electric and hydraulic machinery by William H. Haass, R. W. Pegels, Fred Pegels, Jr., etc. Capital, $10,000.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., May 8, for equipment for steel foundry, including converter, blower, sand crusher and mixer, ladles, ladle heaters and materials for making steel castings; cast-iron wheels for cross conveyer, steel castings, ball governor, ejectors, etc., as per Circular No. 629.

SOUTHERN STATES

The Louisville & Nashville Railroad Company is planning to build car shops at Frankfort, Ky.

The Kelley-Koett Manufacturing Company, Covington, Ky., will erect a new factory for the manufacture of X-ray apparatus.

The Dentler Manufacturing Company, Wheeling, W. Va., has commenced the erection

of its plant. Will make iron castings, window weights, etc.

The Alvey-Ferguson Company, of Louisville, Ky., will move its plant to Oakley, Cincinnati, O. The company manufactures conveying machinery.

Spence, Smith & Kootz, manufacturers of oilwell supplies, Parkersburg, W. Va., will erect a new building to be used as a boiler shop and warehouse.

The J. Harold Ferguson Company, Huntington, W. Va., has been incorporated to manufacture and deal in farming implements, bicycles, automobiles, etc. Capital $25,000. Incorporators, J. H. Ferguson, H. C. Solter, E. M. Ferguson, etc.

WEST OF THE MISSISSIPPI

E. M. Cummens, of Ortonville, Minn., will erect a blacksmith shop.

The Fairmont (Minn.) Machine Company will erect a machine shop.

The Cole Motor Car Company will erect an $8000 garage at Des Moines, Ia.

E. E. Johnson, 2304 Long avenue, St. Paul, Minn., will build a machine shop.

The Missouri, Kansas & Texas Railroad has plans for new shops at Greenville, Tex.

A. Rasmussen, of Council Bluffs, Ia., will erect a two-story, 26x105, blacksmith shop.

The San Dimas Auto Company, San Dimas, Cal., will build a new commercial garage and repair shop.

The McDonnell Boiler and Iron Works, Des Moines, Ia., will rebuild foundry recently gutted by fire.

The Iowa Foundry Company, of Sioux City, Ia., will erect additions, foundry, pattern and machine shops.

The Board of Public Works, Seattle, Wash., is having plans prepared for a new garage to be erected at Dilling Park.

Charles Osner, Seattle, Wash., will build a commercial garage and repair shop. Modern equipment will be installed.

W. P. Patton, Bailey building, Seattle, Wash., is having plans prepared for a commercial garage and repair shop.

M. Oppenheimer, Pacific avenue, Spokane, Wash., is having plans prepared for a commercial garage and repair shop.

The Western Tinware Company, of Omaha, Neb., had a $10,000 fire at its factory. A. W. Gordon, president and treasurer.

The Portland Railway, Light and Power Company, Portland, Ore., is increasing the capacity of its carbarns at North Albina.

Hardood & Hoke, San Dimas, Cal., will build a commercial garage and repair station. Modern equipment will be installed.

M. Keedy, Spokane, Wash., is having plans prepared for a commercial garage and repair shop to be erected on Sprague street.

The Santa Fe railroad will build an addition to its repair shops at San Bernardino, Cal. Autogenous welding equipment will be installed.

The Oregon-Washington Railroad and Navigation Company, Portland, Ore., is planning to increase the capacity of its shops at Pendleton.

The blacksmith shop of James A. Johnson, Shelby, Mont., recently destroyed by fire, will be rebuilt. Mr. Johnson is owner of the Shelby hotel.

Rogers & d'Artenay Manufacturing Company, Sacramento, Cal., manufacturing farm implements, is looking for a site at Lodi for a new factory.

The Covey Motor Car Company, Portland, Ore., has commenced the erection of a large automobile plant and garage. The shop will be fully equipped.

The Pacific Malting and Brewing Company, Tacoma, Wash., has taken out a permit to build a new garage, for use and repair of its trucks.

The engineering department of the Los Angeles (Cal.) Railway Company has prepared plans for new car shops to be erected for Division No. 3.

The Kahan & Falk Company, Railroad avenue, Spokane, Wash., will build a new machine-shop addition to its plant. New machinery will be installed.

The Krane Wonder Manufacturing Company, Rhyolite, Nev., is contemplating the installation of 10 or 20 additional stamps. Homer Wilson, general manager.

The Nevada (Iowa) Implement Manufacturing Company has been incorporated with $25,000 capital and will erect a factory for the manufacture of farm machinery.

The Wood-Knight Hawk Company, Oklahoma City, Okla., has been incorporated with a capital of $250,000 to manufacture a new motor plow. H. D. Knight, president.

The Idaho Electric Manufacturing Company, Pocatello, Idaho, has been organized. The company will build a factory for the manufacture of electric burning appliances.

Oscar Regansburg, Byrne building, Los Angeles, Cal., will build a new machine shop on Violet street. It will be operated by John S. Underwood and will be fully equipped.

The Commercial Aërial Navigation Company, Webb City, Nev., has been incorporated with $50,000 capital to manufacture airships, by Jesse A. Turnage, J. H. Billings, Peter McEntee.

The California Aëro Manufacturing and Supply Company, San Francisco, Cal., has leased a building on Golden Gate avenue, and will establish a plant for the manufacture of its specialties.

The Llewellyn Iron Works, Los Angeles, Cal., manufacturing elevators and working in structural steel, has had a representative at Seattle, Wash., looking for a site for a new plant. Portland, Ore., is also being considered.

CANADA

The Grand Trunk Pacific will build new shops at Regina, Sask.

The Canada Ford Company, electrical supplies, will locate a plant at Montreal.

The Norton Griffiths Steel Company are building a large new plant at Vancouver.

The Canadian Northern Railway will build big new car shops at Fort Frances, Ont.

The Canada Metal Company, of Toronto, will establish a branch factory in Winnipeg.

The Massey-Harris Company, of Toronto, will erect a branch plant at Lethbridge, Alberta. The company manufactures reapers.

The Northern Engineering and Supply Company, manufacturing builders' supplies, will build a large new factory at Fort William, Ont.

The Atikokan Iron Company, Port Arthur, Ont., will erect a foundry in connection with its furnace, for the manufacture of pipe, and also enlarge its blast furnace. J. Dix Fraser, superintendent.

J. C. Wallace, of the American Ship-Building Company, of Cleveland, O., who is interested in the Western Dry Dock and Ship-Building Company, of Port Arthur, has announced that the Western Dry Dock and Ship-Building Company would immediately start work on the erection of an additional plant to manufacture stationary, marine and locomotive boilers, engines, pumps and general engineering contracting. The company will build docks. A large amount of machinery will be required.

GENERAL MANUFACTURING

NEW ENGLAND

Freeport, Me., will build a new water-supply plant.

Amherst (Mass.) Gas Company will make improvements in its plant.

Rockland, Mass., contemplates building a municipal light and power plant.

The Stoughton Rubber Company will build a new factory at Canton, Mass.

The United States Worsted Company will build a six-story mill at Lawrence, Mass.

W. J. Reid, Harbor View, Mass., is in the market for a small surface planer for wood.

Middlebury College, Middlebury, Vt., will make additions to its heating and power plant.

The American Rubber Company, of Cambridge, Mass., will build an addition to its plant.

E. A. Mallory & Sons, New Haven, Conn., will erect a four-story addition to their hat factory.

The Central Maine Power Company will build a new steam-electric plant at Farmingdale, Me.

Bradley & Scoville, Incorporated, stationery, etc., New Haven, Conn., will build a new factory.

The Munroe Felt and Paper Company will erect a new mill at Lawrence, Mass. Cost about $10,000.

The Sheldon Printing Company, Moosup, Conn., are in the market for a second-hand pony cylinder press.

The Boston Duck Company has awarded contract for construction of addition to mill at Bondsville, Mass.

The Home Bleaching and Dye Works, Pawtucket, R. I., have under way a new three-story addition to their plant.

The National Wadding Company, Charlton, Mass., has purchased a factory at Marlboro, Mass., and will remove its business to that place.

George Lawley & Sons Corporation, yacht builders, South Boston, Mass., will move to Neponset, Mass., where they have secured the property of the Putnam Horse Shoe Company.

MIDDLE STATES

Reliable Laundry, Toledo, O., is building a new three-story plant.

The Marshfield (Wis.) Stave Company sustained a total loss by fire.

The plant of the Buffalo (N. Y.) Glass Company was destroyed by fire.

The Robesonia (Penn.) Knitting Mill was destroyed by fire. Loss, $23,000.

New Hartford, N. Y., is considering the erection of a sewage-disposal plant.

The plant of the Ohio Valley Furniture Company, Gallipolis, Ohio, was burned.

The Hopkins elevator at Rensselaer, Ind., has been destroyed by fire. Loss, $60,000.

Findeiss & Heckel, Zanesville, Ohio, tanners, will build an addition to their plant.

The Findeiss & Heckel Oak Leather Company, Zanesville, O., will enlarge its plant.

Fire destroyed the plant of A. Hoen & Co., lithographers, Richmond, Va. Loss, $100,000.

Fire destroyed the factory of the New York Piano Key Company, Middletown, N. Y.

Fire did $10,000 damage in the factory of the Boston Glove Company, Gloversville, N. Y.

Fred Pfund is erecting a cold-storage plant at 3949 Germantown avenue, Philadelphia, Penn.

Fire destroyed the plant of the Cohoes (N. Y.) Dyeing Company, causing a loss of $18,000.

Fire destroyed the plant of the Pierce Glass Company, St. Marys, Penn. Estimated loss, $60,000.

The Brannum-Keene Lumber Company, Indianapolis, Ind., is building an addition to its mill.

The Swansdown Knitting Company, Hudson, N. Y., is planning the erection of an addition.

The American Viscose Company will add two new buildings to its plant at Marcus Hools, Penn.

Fire destroyed the bakery and adjoining buildings of Paul Wessells at Peekskill, N. Y. Loss, $10,000.

E. R. Godfrey & Sons, Milwaukee, Wis., are having plans drawn for a $100,000 cold-storage plant.

The Empire Button Works, of Muscatine, Ia., have rented quarters for a factory in Marlboro, N. Y.

The Orenstien trunk factory, of 2117 Germantown avenue, Philadelphia, was damaged by fire. Loss, $2000.

Percy Bentley, architect, at La Crosse, Wis., has completed plans for a cold-storage plant at New Albin, Ia.

The New York State legislature has passed a measure providing for a new water system for Mount Vernon, N. Y.

Toledo Biscuit Company, Toledo, O., is planning on a new five-story plant. E. Bettridge, general manager.

The Citizens Electric Light, Heat and Power Company, of Yonkers, N. Y., has about decided on site for power plant.

The Philadelphia (Penn.) Electric Company has purchased a site for its power house at Devereaux and Milnor streets.

The City of Cleveland, O., will newly equip the old Division Street pumping station. Cost estimated at $300,000.

Plans have been prepared for a paving brick plant to be erected by the Ashtabula Shale Brick Company, at Ashtabula, Ohio.

Stuart Dalton has been granted a permit to build a boiler house at Holmesburg Station (Penn.) on the Pennsylvania railroad.

At Cincinnati, Ohio, plans have been prepared for an addition to the plant of the Charles Boldt Glass Company, on Davis Lane.

W. W. Kincaid, M. W. Beeman, J. B. Leffup and J. F. Kitchen, of Meadville, Penn., will build a corset factory at Niagara Falls, N. Y.

The Acme Tea Company will build a bread-making plant, including a power house at Twenty-fifth and York streets, Philadelphia, Penn.

David Weber & Co., making paper boxes, have purchased a site at the northwest corner of Fifth and Locust streets, Philadelphia, Penn.

Williamson Brothers, machinists and engineers, are having a power house built at Moyer and Adams streets, Philadelphia, Penn.

The Franklin Brewing Company, of Columbus, Ohio, will award a contract in the near future for a large addition to its engine room.

The Lincoln Electric Company, of Cleveland, O., has increased its capital from $10,000 to $200,000. Enlarging of its plant is contemplated.

The Indianapolis Water Company, Indianapolis, Ind., will make improvements at once at its Riverside pumping station, to cost above $10,000.

The Tellings Brothers Company, Cleveland, O., has bought a site in Youngstown, O., and will build an ice and ice-cream plant on it at a cost of $30,000.

Henry Bower Chemical Manufacturing Company, Philadelphia, Penn., will make extensions and alterations to its plant at Schuylkill and Stanley streets.

The Albany (N. Y.) Display Case Company has been organized to manufacture show cases. Capital $10,000. Directors, Winslow M. Mead, Adolph Meyer, George D. Babbitt, etc.

A building permit has been issued for a new mill for the H. H. Sheip Manufacturing Company, at Sixth and Columbia avenues, Philadelphia, Penn., lumber and cigar-box makers.

The Acme Box Company, Cincinnati, Ohio, has been incorporated to manufacture boxes and other lumber articles by Joseph P. Baker, S. C. Baker, W. J. Townsley, etc. Capital, $25,000.

The Keystone Glue Company, of Williamsport, Penn., has purchased a 45-acre site at South Milwaukee; will put up a $300,000 plant. Fred W. Rogers, of Milwaukee, is interested.

At Dayton, Ohio, A. F. Shepard, superintendent of the Dayton State Hospital, will receive bids May 23, for furnishing and erecting a complete 25-kilowatt direct-current generator.

The Crystal Glass Company, Pleasantville, Ohio, has been formed to manufacture and sell glass of all kinds. Incorporators, Earl L. Bastian, J. M. Sheets, Harry F. West, etc. Capital, $65,000.

The American Foundry and Construction Company, Pittsburg, Penn., has been issued a permit to build a two-story brick and steel pattern shop at Hazlewood and Second avenues, to cost $14,000.

The James C. Beatty & Sons Manufacturing Company, Frankfort, Ind., has been incorporated with a capital of $10,000 by J. C. B., G. K. and G. O. Beatty, to manufacture kitchen cabinets.

The Ferrand Manufacturing Company has been incorporated with $50,000 capital and will enlarge and remodel the Schoepflin mill for grinding flour at Gardenville, N. Y. Augustus B. Ferrand is president.

Alvin Johnson, William Rafferty and Dr. E. R. Sisson, all of Greenfield, Ind., will erect a factory building in that city, for the manufacture of a newly patented cement refrigerator, the invention of Mr. Johnson.

The Ideal Wheel Company, Cincinnati, Ohio, has been organized with $25,000 capital to manufacture wooden and metal wheels for all classes of vehicles. Incorporators, Louis M. Rouda, B. L. Mattox, Victor E. Julian, etc.

The Molden Novelty Manufacturing Company's plant at Greenfield, Ind., which has been shut down for many months, will be started with a full force of workmen. The company manufactures handles for tools and other small wood work.

The Board of Education, Toledo, O., will receive bids on May 15 for an electric-light and power system and other electrical apparatus for the Scott and Waits high schools which will cost approximately $400,000 each. Information may be secured from G. L. McKesson, director of schools.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids May 23, as follows: 360 galvanized iron or steel buckets, 250 cans and cases, emery cloth, twist drills, files, hardware, hinges, machine and wood screws, taps and dies, gasolene torches, bench and saw vises, pipe wrenches (schedule 3522), rod brass, bronze, steel angles, sheet steel, plate steel, zinc plates, sheets (schedule 3521), sheet copper, brass, brass pipe copper and iron pipe (schedule 3523).

SOUTHERN STATES

Colquitt, Ga., will erect a $75,000 electric-light plant.

The Manetta Mills, Lando, S. C., will build a two-story addition.

The Springfield (Tenn.) Woolen Mills Company will enlarge its plant.

Fire destroyed the plant of the Jacksonville Lumber Company, Jacksonville, Fla.

Fire destroyed the plant of the Doscher-Gardner Lumber Company, Jacksonville, Fla.

Fire destroyed the plant of the Lancaster (Ky.) Electric Light Company. Will be rebuilt.

The Southern Power Company, Dunham, N. C., has purchased site for distributing station.

WEST OF THE MISSISSIPPI

W. C. Brown will build a feed mill at Claremont, Minn.

W. T. Angelo, Lodi, Cal., is building a new basket factory.

Robert Shaver, Centralia, Wash., will build a new sawmill.

T. E. Lund will erect a planing mill at Pelican Rapids, Minn.

Christ Hertz will erect a cement-block plant at New Leipzig, N. D.

Canterbury Brothers, Higginsville, Mo., will erect a 10-ton ice plant.

The Lewistown (Mont.) Brick and Tile Company will erect a large plant.

The city of Hood River, Ore., will install a waterworks system to cost $90,000.

The Fakler Bottling Works, of Rochester, Minn., will erect a two-story factory.

W. H. Anderson, of Ogden, Utah, will erect a cold-storage plant at Kearney, Neb.

J. B. Agen Company, of Willmar, Minn., will erect an addition to its creamery.

The Dom Bastanchury Ranch, East Whittier, Cal., will install a new pumping plant.

The Ennis (Tex.) Ice, Light and Power Company will install additional ice machinery.

J. A. Johnson, of Keosaqua, Iowa, has been granted a franchise to install an electric plant.

The pumping plant of the Seattle (Wash.) Brewing and Malting Company was destroyed by fire.

The city of Winters, Cal., is planning to issue bonds for the installation of a sewer system.

The city of Caldwell, Idaho, is planning for the installation of an electric-lighting system.

The Hampton-Kelley Canning Company, Hampton, Iowa, will increase the capacity of its plant.

Runkle & Smiley, Lewiston, Idaho, will build a factory for the manufacture of cement blocks.

The Coast Lumber Company, Boise, Idaho, has taken out a permit to build an addition to its plant.

Bridgeman & Russell, of Duluth, Minn., are considering the erection of a creamery at Harris, Minn.

The Coalinga Mohawk Oil Company, Coalinga, Cal., is planning for the erection of a new boiler plant.

The Cove Power Company, Princeville, Ore.,

will build a power plant on Crooked river, near Culver, Ore.

E. Erickson, of Eden Valley, Minn., has let contract for a creamery to Boerner Brothers, of Buffalo.

The Anderson & Middleton Mill, at Aberdeen, Wash., will put in an electric power house at their plant.

The Holmes Milling Company, Portland, Ore., has purchased property and will build a grain-milling plant.

A franchise has been granted to the Faith (S. D.) Light and Power Company to install an electric-light plant.

W. H. Grover, of Ames, Iowa, will commence the construction of an electric-light plant at Jewell, Iowa.

W. F. Whittier, Hemet, Cal., is planning for extensive improvements and additions to the local water system.

The Nelson Sash and Door Company's plant, at Duluth, Minn., was damaged to the extent of $10,000, by fire.

The city of Spokane, Wash., is planning to install a sewer system in Manito Park addition to cost about $83,000.

The Minnesota Screen Company, of Virginia, Minn., has secured a site for the erection of a two-story plant.

M. W. Fockler, of Winona, Minn., will erect a plant to supply power to Endicott, Winona, Minn., and La Crosse, Wis.

Everly & Collins, Castlerock, Wash., are planning to build a power plant on the Toutle river in this district.

Charles Guide is considering the erection of a plant for the manufacture of a new drill machine at Beach, N. D.

The Santa Monica Bay Telephone Company, Santa Monica, Cal., is having plans prepared for a new substation.

The Weinhard Brewery, Portland, Ore., has taken out a permit to make improvements and additions in its power plant.

The Susanville Water Company, Susanville, Cal., will make improvements and enlargements in its waterworks system.

The Apple Growers' Union, Underwood, near White Salmon, Wash., is planning to increase the capacity of its plant.

The Pine Creek Creamery Company, Spokane, Wash., is planning to build a new creamery plant at Grangeville, Idaho.

The city of Newport, Ore., will install a new sewer system. L. C. Kelsey, Portland, Ore., has been retained as engineer.

Anton Hessell, president Union Brewing Company, Los Angeles, Cal., is having plans prepared for an addition to his plant.

The Hydroelectric Company, Bodie, Cal., whose power plant was recently destroyed by a snowslide, will immediately rebuild.

The American Beet Sugar Company, Denver, Colo., is preparing plans for a new factory building to be erected at Chino, Cal.

Power-plant equipment will be required for the new 10-story building to be erected by A. B. Cohn, capitalist, Los Angeles, Cal.

The city of Stockton, Cal., is planning for the installation of an underground electric-lighting system. Estimated cost, $35,000.

The Von Behren Manufacturing Company, Evansville, Ind., making wagon and carriage wood stock, will erect an addition to its plant.

The Salem (Ore.) Woolen Mills (Thomas Kay), will make improvements and additions in its power plant. New equipment will be added.

The Washington Cabinet and Casket Company, Seattle, Wash., is planning to build a new plant for the manufacture of its specialties.

The city of Elgin, Ore., will make extensive improvements in its water system. J. R. Thompson, Portland, has been engaged as engineer.

The Perfect Brick Machine Company (Mr. Prescott), Portland, Ore., will establish a plant for the manufacture of cement brick and tile.

The Polk county court, Dallas, Ore., has authorized the purchase of two large rock crushers. The county court is in charge of this work.

The Nez Perce Water and Power Company, Kamiah, Idaho, has been granted a lighting franchise. The company will soon commence operations.

The Sunset Brewery (Homer Brown), Wallace, Idaho, is having plans prepared for a new plant. New machinery will be installed throughout.

J. A. Jones, Canton, Ohio, will build a large gas plant at Pocatello, Idaho. A franchise has been granted and construction will soon begin.

The F. S. Harmon Furniture Company, Spokane, Wash., has purchased property and will build a plant to cost $100,000 in the near future.

The Helena (Mont.) Light and Railway Company will issue bonds for $100,000 to be used in making improvements and extensions in its systems.

The city of Baker, Ore., has voted bonds for $185,000 for the building of a waterworks system and the establishment of a municipal lighting plant.

The engine plant and nitrating house of the Trojan Powder Company, San Lorenzo, Cal., were destroyed by fire. All machinery was demolished.

The Park Commission, Los Angeles, Cal., is contemplating the installation of a pumping plant in connection with other improvements at Griffiths Park.

The Cold Water Paint Company, Bryman (San Bernardino county), Cal., will build a new paint-manufacturing plant and clay-washing refinery.

Power-plant equipment will be required for the 12-story office building which is planned by the Title Insurance and Trust Company, Los Angeles, Cal.

The Mount Vernon Telephone Company, Dayton, Wash., has been granted a franchise to operate in this vicinity and will soon commence construction.

The city engineer, Portland, Ore., is preparing plans for a large sewer system to be installed in the Brooklyn district. Estimated cost, $500,000.

The Pelican Bay Lumber Company, Klamath Falls, Ore., will build a large sawmill and box factory. H. D. Mortenson is president of this company.

Power-plant equipment will be required in the new 12-story office building to be erected at Portland, Ore., by I. Gevurtz & Son. Plans are now being prepared.

The city of Lewiston, Idaho, is in the market for auxiliary equipment for its centrifugal pumping station. The city engineer is in charge of this work.

Fred J. Cross, of Monticello, Iowa, will erect a power plant to supply electric light to Coggon, Central City, Center Point, Walker and Springville, Iowa.

The Home Telephone Company, Los Angeles, Cal., is planning to building a power plant and distributing station at South Pasadena to cost about $50,000.

J. O. Baumgarten, Camden, N. J., has secured a site at Bakersfield, Cal., and will build a large brewery plant. The initial expenditure will total $200,000.

The Missouri Valley High Carbon Fuel Company is planning the construction of a 300-ton daily capacity briquet plant at Minot, N. D. Thos. Peebles, secretary.

The Pacific Coast Condensed Milk Company, Seattle, Wash., will erect two 2-story concrete buildings, 150x275, at Chilton, Wis. Eight boilers will be installed.

The Ladd estate, Portland, Ore., will install a water and sewer system in its property at Eastmoreland. With other improvements, $900,000 is to be expended.

The Great Western Power Company, San Francisco, Cal., has been granted a light and power franchise at Auburn. The company will soon commence operations.

The J. S. Beall Manufacturing Company, Portland, Ore., has purchased property and will build a factory for the manufacture of contractors' supplies and steel culverts.

The Builders' Supply Company, Everett, Wash., has commenced the erection of a factory for the manufacture of wood-building specialties. The plant will be modern.

Power-plant equipment will be required in the new building to be erected by the Madison Square Building Company, Seattle, Wash. About $200,000 will be expended.

Power-plant equipment will be required in the new 10-story department store to be erected at Portland, Ore., by Lipman, Wolfe & Co., Portland. Estimated cost, $650,000.

The Olympia Laundry Company, Tacoma, Wash., is planning to build a large addition to its plant. Modern equipment will be installed. M. J. Buren is head of this company.

F. C. Runyon, San Francisco, Cal., president of the Mill Valley & Tamalpais Railway Company, is planning to install a complete waterworks system at Dipsea, a Pacific coast resort.

The Seven Grain Food Company, Chamber of Commerce, Los Angeles, Cal., is having plans prepared for a new factory building near Watts. Modern equipment will be installed.

The Pacific Fruit Express Company, Portland, Ore., F. A. Herring, general agent, will build a large ice plant at Nampa, Idaho. The plant will be fully equipped with pre-cooling machinery.

Power-plant equipment will be required in the new eight-story building to be erected by John Martin, capitalist, San Francisco, Cal. About $400,000 will be expended. Plans are being prepared.

The Carbolineum Company (L. R. Mason, manager), Centralia, Wash., is planning ta build a factory in this vicinity for the manufacture of a wood-paving block. About $40,000 will be expended.

The Pacific Fruit Cooling and Vaporizing Company, Lodi, Cal., is planning for the erection of a pre-cooling plant to cost $30,000. Heavy refrigerating machinery for this purpose will be installed.

Power-plant equipment will be required in the new building to be erected by the Washington State Art Association, Seattle, Wash. Estimated cost, $500,000. Kingsley & Eastman, architects, Seattle.

The Prairie Development Company (D. K. McDonald), Spokane, Wash., will install a waterworks system in the town of Bayview, near Spokane. Charles Wolfe is engineer. Estimated cost, $20,000.

The plant and machinery of the Imperial Valley Ginning Company (cotton), Calexico, Cal., was damaged by fire. Loss, $8000. The plant will be rebuilt and new machinery installed in the near future.

The Pacific Coast Company, Seattle, Wash., is contemplating the erection of a plant on Lake Washington for the manufacture of

briquets from refuse coal. The factory is estimated to cost about $150,000.

The Toliver Aërial Navigation Company, San Diego, Cal., will build a gas-manufacturing plant to be used in connection with its factory for the building of dirigibles. Gas-generating equipment will be installed.

The Nevada-California Power Company (Delos A. Chappell, president), Goldfield, Nev., is planning to build a new power plant. The company is rebuilding its plant at Jordan, Cal., which was recently damaged.

R. L. Van der Naillen, Oroville, Cal., formerly with the Oro Water, Light and Power Company, of Oroville, is at the head of a new $10,000,000 company, which is planning to build a large power plant on the Feather river cañon.

The Krohn Electric Company has been incorporated at Los Angeles, Cal., by Julius K. Krohn and Wm. E. Servis, with a capital stock of $5,000,000. The company will build a factory for the manufacture of a patented electric battery.

The State engineer, Sacramento, Cal., is preparing plans for a gas-generation and electric power plant to be erected at the Southern California State Hospital, at Patton. The legislature has appropriated $55,000 for the installation.

The Redondo Beach Ice and Cold Storage Company, Redondo Beach, Cal., recently incorporated, is having plans prepared for an ice and refrigerating plant of 2 tons daily capacity. The company is also planning to establish a fish-curing plant. Fred Parker is president of this company.

CANADA

Additions will be built to Becks' box factory at London, Ont.

The Canadian Bag Company, of Winnipeg, will extend its plant.

The Sarnia Fence Company, of Sarnia, Ont., will extend its plant.

The Hourd Furniture Company, of London, Canada, will double its factory.

. Victoria, B. C., will make important extensions to its electric-lighting plant.

The Czerwinski Box Company is building a new $75,000 factory at Winnipeg.

The North Pacific Power Company will locate a big plant near Vancouver, B. C.

The Spatsum Gypsum Company will equip a very large refinery at Spatsum, B. C.

Important improvements will be made at the Beach pumping station at Hamilton, Ont.

The George H. Mason Lumber Company will equip a very large new planing mill at Ottawa.

Fire destroyed $14,000 worth of machinery in Kent & Co.'s mill at Walkerton, Ont. Will be replaced.

The Dominion Tar and Chemical Company will equip a $250,000 plant near Winnipeg for creosoting wood products.

P. G. Majeau, of Montreal, is head of the Modern Gas Light and Power Company, which will build a big, new plant there.

The Ontario West Shore Railway Company, of Goderich, Ont., will make important extensions requiring new equipment.

W. Bain, of Toronto, is head of the Fort Frances Pulp and Paper Company, which will locate a big plant at Fort Frances.

The City of Toronto will buy a large number of vertical electrically driven pumps, motors and other electrical equipment. Tenders close June 6.

Thirty thousand dollars' worth of machinery destroyed by fire in the mill of the Peel Lumber Company, at Stickney, N. B., will be replaced at once.

MINING

The Colorado mine, Jalisco, Mex., is planning the erection of a cyanide plant.

The Giant mine, Battle Mountain, Nev., has broken ground for a new 5-stamp mill.

The Busy Bee Mining Company, Beaver, Utah, is planning to install a 10-stamp mill.

The Victoria Mining Company, operating at Eureka, Utah, will install new machinery.

The Marc Antony mine, Smartsville, Cal., is planning for the erection of a 50-stamp mill.

The Esmeralda-Barrel property, Chihuahua, Mex., is planning to install a cyanide plant.

The Arizona Copper Company, Clifton, Ariz., will build a new smelting plant in the near future.

The Utah Copper Company, Salt Lake, Utah, will increase the capacity of its plant at Garfield.

The First Thought mine, near Orient, Wash., is planning for the erection of a cyanide plant.

The Calumet & Hecla Mining Company, Calumet, Mich., will, it is said, build a new regrinding mill.

The Adargas mine, Jimenez, Chihuahua, Mex., is planning for the erection of a large mill sometime in 1911.

The Goldfield (Nev.) Mining and Ore Reduction Company will be in the market for a four-drill compressor.

The Anglo-Mexican Mining Company, operating in Durango, Mex., is planning to install a 500-ton cyanide plant.

The Jersey mine, in Jersey valley, vicinity of Winnemucca, Nev., is planning to install a 50-ton concentrating plant.

The Socorro Mines Company, operating near Mogollon, N. M., is contemplating the installation of crude-oil engines.

H. A. Kelly, Santa Ines, Oaxaca, Mex., is at the head of a project to build a large smelting plant in this district.

The Buckeye Mining Company, operating at Goldfield, Nev., is planning for the erection of a 50-ton reduction plant.

The Palmarejo mine, Sonora, Mex., has commenced the erection of a 500-ton mill. The plant will be fully equipped.

The Big Fourteen mine, operated by F. W. Snow, at Stateline, Utah, is planning for the erection of a 5-ton milling plant.

The Bartholf mine, Willow Creek district, Alaska, will increase the capacity of its stamp mill during the coming summer.

The Cleveland mines, operated by G. H. Utter, at Pinos, Nev., is planning for the erection of a 50-ton concentrating plant.

The Davidson Quartz mine, near Shingle Springs, Cal., is planning to install a large amount of new machinery. A mill will also be erected.

The Engels Copper Mining Company, operating in the Lights cañon district, near Greenville, Cal., will install an aërial tramway in June, 1911.

The Yoquivo Development Company, operating in the Cuesta Hrieta district, Chihuahua, Mex., is planning to increase the capacity of its cyanide plant.

James E. Elwell, Denver, Colo., formerly connected with the Grand Smelting Company, of this city, is planning for the erection of a smelting plant in Lemhi county, Idaho.

The American Meerschaum Company, operating at Hanover, N. M., is planning to build a plant for the mining of meerschaum. It is stated, that this will be the first mill ever to be erected for this purpose. The owners are interested in such machinery as may make it efficient. C. W. Osterwald is consulting engineer for the company.

The Godiva Mountain Leasing Company, operating at Eureka, Utah, is planning to install a cyanide plant. G. T. Castleton is head of this company.

BUSINESS ITEMS

The Boston office of the Sprague Electric Company has been moved to 201 Devonshire street.

The Orenstein-Arthur Koppel Company, Koppel, Penn., has placed an order with Tate, Jones & Co., Pittsburg, Penn., for a complete oil burning equipment and furnaces.

The J. T. Slocomb Company, Providence, R. I., manufacturer of inside, outside and thread micrometer calipers, standard reference gages, standard end gages and combination center drills, reports its orders very good. Owing to its rapidly growing business it has secured the services of Edward Blake, Jr., as general manager. Mr. Blake was formerly manager, sales department, Wells Brothers Company, Greenfield, Mass., and treasurer, Canadian Tap and Die Company, Galt, Ont.

The National Brake and Clutch Company, of Boston, Mass., when originally organized, was interested in the manufacture and use in automobiles and street cars of cork-insert clutches and brakes. The scope of its business has so broadened among almost every class of power user by the introduction of its cork inserts in many types of pulleys, clutches, brakes, frictions, tensions, etc., that it has changed the name of the corporation to one more indicative of the business as present conducted, and hereafter the business will be known as the Cork Insert Company.

TRADE CATALOGS

Narragansett Machine Company, Providence, R I. Circular. Disk grinding machine. Illustrated.

Frank Mossberg Company, Attleboro, Mass. Circulars. Socket wrenches, double-end wrenches, automobile wrenches. Illustrated.

The Manville Brothers Company, 25-33 Benedict street, Waterbury, Conn. Catalog. Foot presses. Illustrated, 8 pages, 5x7½ inches, paper.

International Engineering Company of New Jersey, 1779 Broadway, New York. Catalog R B F ball bearings. Illustrated, 68 pages, 6x9 inches, paper.

The Springfield Machine Tool Company, Springfield, O. Catalog G. Lathes, shapers, bench-straightening press, pneumatic press. Illustrated, 64 pages, 6x9 inches, paper.

Thomas H. Dallett Company, Philadelphia, Penn. Bulletin No. 203. Duplex and compound belt-driven air compressors. Illustrated. Bulletin No. 204. Duplex and compound steam-driven air compressors. Illustrated.

CATALOGS WANTED

The Miller-Sandy Machinery Company is opening a new machine-tool store at 1621-23 Main street, Kansas City, Mo., and would be pleased to receive catalogs from manufacturers of machine tools, engines, boilers, pumps, machinists' supplies.

FORTHCOMING MEETINGS

National Association of Manufacturers, annual convention, May 15, 16, 17, Waldorf-Astoria hotel, New York city. Geo. S. Boudinot, secretary, 30 Church street, New York city.

National Machine Tool Builders' Association, spring meeting, May 18-19, 1911, Hotel Marlborough-Blenheim, Atlantic City. Chas. E. Hildreth, secretary, Worcester, Mass.

International Master Boiler Makers' Association, Omaha, Neb., May 23, 24, 25, 26, 1911.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

Society of Automobile Engineers, midsummer meeting, Dayton, Ohio, June 15, 16 and 17, 1911. C. F. Clarkson, secretary, 1451 Broadway, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

Wanted—To buy a small machine shop in New England. Box 778, AMER. MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

"Engineering Data." Brown & Sharpe grinding practice on May list. Box 788, AMERICAN MACHINIST.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—A specialty in iron or steel to manufacture on royalty or otherwise. Address, Original Novelty Company, Muskegon, Mich.

Wanted—Work for gear cutters, hand turrets, milling machines, etc.; fine work in quantities. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Gear cutting, spur, bevel spiral wanted; parts machinery and complete machines built. The T. C. M. Manufacturing Co., 46 Lawrence St., Newark, N. J.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

We can save you time and money, designing your machinery, tools, jigs and fixtures; let us develop your ideas and make your patent office drawings. Toledo Engineering Co., 544 Oakwood Ave., Toledo, Ohio.

Wanted—We are in the market to have a number of machines built about medium weight; only house with first class tools and in the vicinity of New York need answer this ad. Box 773, AMERICAN MACHINIST.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Breakdowns. Portable autogenous welding plant crated for quick shipment, avoiding necessity dismantling broken engines or large machinery; save money and valuable time. Waterbury Welding Works, Waterbury, Conn.

Free tuition by mail: Civil service, mechanical drawing, stationary engineering, electric wiring, agriculture, poultry, normal, bookkeeping, shorthand and typewriting courses. For free tuition, apply Carnegie College, Rogers, Ohio.

Welding by oxy-acetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together; write for particulars. Krajewski-Pesant Co., 54 Beard St., Brooklyn, N. Y.

$1.50 will buy complete set of castings and all material for a neatly designed automatic steam engine of 1/16 horsepower; engine has rotary valve with adjustment for wear. Blueprints and instruction sheets 25 cents; complete engine ready to run $6. Dept. A, Elgin Wheel and Engine Company, Elgin, Ill.

Proposals for ordnance supplies. Watervliet Arsenal, Watervliet, N. Y., April 15, 1911. Sealed proposals, in triplicate, will be received until 1 p.m., May 15, 1911, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1912; information furnished on application. Lieut-Col. W. W. Gibson, Commanding.

Wanted—Machine work; a thoroughly well equipped machine tool shop, having accumulated considerable of its own product, and desiring to employ its full organization, is open for work of good class, and solicits contracts from $500 to $50,000; location, Central West. Box 765, AMERICAN MACHINIST.

An inventor of several compressed air and steam specialties for which there is a growing demand with no competition, would like to arrange with reliable concern to manufacture same on royalty; this would mean a clean and profitable manufacturing business to parties who would do as they agree. Address "Steamair," AMERICAN MACHINIST.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Young man as assistant draftsman; state experience, etc. Apply The Smart-Turner Machine Co., Limited, Hamilton, Can.

CONNECTICUT

Wanted—First-class grinder on ball-race grinding machines. B. L. Co., Norwich, Conn.

Wanted—A first-class man for automatic screw machine work, who has had experience on National-Acme and Gridley. B. L. Co., Norwich, Conn.

ILLINOIS

Exceptional opportunity for a young, agressive and thoroughly competent tool maker and hardener of good address, familiar with use of high speed steels, as a tool steel salesman; if anxious to rise above shop limitations, give age, education, shop experience, salary expected and references in first letter. If you are not a live wire don't answer. R. D. Van Valkenburgh, 213 West Lake St., Chicago, Ill.

Head draftsman wanted, a tool designer to assume charge of the tool drafting room of a large manufacturing company in the Middle West; must be a man of good education, of extensive practical experience on fine tools, jigs, fixtures, as well as machinery designing; the right man will find this a most desirable position; in answer, give full details of experience and business connection, age and salary expected. Box 817, AMER. MACHINIST.

MASSACHUSETTS

Boring mill operator wanted for Niles horizontal; conditions and pay good. Deane Steam Pump Company, Holyoke, Mass.

MICHIGAN

Wanted—High-grade detail draftsmen and tracers, experienced on automobile work; must be neat and accurate; state age, education and salary expected. Address John Springer, chief draftsman, Brush Runabout Company, Detroit, Mich.

Wanted—First-class tool-room foreman of general all around experience for small rapidly growing concern making auto frames and heavy stampings; excellent opportunity for hustler who can handle help and get results; state fully experience, references, age and salary expected, also date you could start. Box 813, AMERICAN MACHINIST.

Wanted—A factory superintendent for a steel stamping plant that is turning out a line of metal fixtures, novelties and hardware specialties; first class equipment for dies as well as production; growing business; splendid opportunity for a man who knows and can produce; attractive salary, and to the right man an interest if agreeable. Box 753, AMERICAN MACHINIST.

MISSISSIPPI

Wanted as foreman of shop, experienced machinist; must be draftsman and familiar with manufacture and operation of generally used printing presses; give references, experience and salary expected. Panchrome Press Mfg. Co., Corinth, Miss.

NEW JERSEY

Wanted—General inspector for shop in metropolitan district, whose products consist of light structural steel, sheet iron and machine work. Good opening for man now employed; state experience, present position and age. Box 812, AMERICAN MACHINIST.

Wanted—An experienced designer for light special machine tools and fixtures; thorough shop and drafting room experience necessary; some electrical training desirable; steady employment to competent man with an established record. Chief Engineer, Edison Laboratory, Orange, N. J.

Wanted—Young man as inspector or foreman in sheet-iron and light structural shop in the metropolitan district; must be thoroughly competent to handle both classes of work; good opportunity for man now employed; give experience, present position and age. Box 811, AMERICAN MACHINIST.

NEW YORK

Wanted—Experienced operators for Gridley, Acme and Cleveland automatics; state experience and wages. King Sewing Machine Company, Buffalo, N. Y.

Wanted—A first class designer for special printing machinery; only those who can furnish the best of references need apply. Box 566, AMERICAN MACHINIST.

Wanted—Young man for selling, office work, drafting; small metal chocolate mold factory in New York; apply in own hand writing, stating experience, age and salary. W. H. Warren, 43 Linden avenue, Flatbush, New York.

Foreman (night shift) for company using automatic wire forming and working machines; one who has had experience in handling help, also some machinist knowledge; steady employment and good wages. Box 796, AMERICAN MACHINIST.

Wanted—A man with scientific or legal training; one whose personal development has been along the lines of reason and logic rather than special experience; permanent position, near New York City, good future. Box 789, AMERICAN MACHINIST.

Wanted—Assistant tool room man; one who has had experience in tool room of shop

under the Taylor system in tool making, grinding and checking; good opportunity for bright young man; state fully experience, references, age and salary expected. Box 752, AMERICAN MACHINIST.

Wanted—Superintendent with good executive ability and education; to have full charge of plant manufacturing high grade machine tools; must be competent to direct designing of new machine tools and special fixtures for accurately producing duplicate parts in quantities; state fully experience, education, age and salary. Box 781, AMERICAN MACHINIST.

Wanted—Time study man and speed boss experienced in shop under the Taylor system; must be thorough machinist, capable analyzing and standardizing operations and taking time studies, and able later to hold position as speed boss; state fully experience, references, age and salary expected to start; good future opportunity for right man. Box 751, AMERICAN MACHINIST.

A large, well established company, making special patent machinery with offices and factories in different countries, has a vacancy for a capable, energetic uptodate business man of unimpeachable integrity, to take charge of their main American office located in New York; must be able to invest at once $75,000 in the company's preferred stock paying quarterly dividends at the rate of 7 per cent. per annum; salary to commence, $3500 per annum, to be advanced to six thousand in the course of time; full investigation and references required and given. Box 802, AMERICAN MACHINIST.

Works Manager Wanted—An old established and well organized company, employing about one thousand men, and manufacturing a high class product, wishes to secure a capable works manager of large experience in the production of small and accurate mechanisms, such as adding machines, typewriters, firearms, etc.; man under 40 years of age preferred; applicants are requested to give their experience in full, state age, positions occupied and furnish list of references; to the right man a permanent position is assured, at liberal salary. Box 772, AMER. MACH.

Mechanical or electrical engineer wanted by a large machinery manufacturing concern doing an international business, to take the position of treasurer and office manager of the company's home office in New York; salary three thousand per annum to commence, to be advanced to five or six thousand per annum; must be a capable man for his position, and be prepared to immediately invest fifty thousand dollars in the company's preferred stock paying 7 per cent. annual dividends quarterly; first class references given and expected. Box 803, AMER. MACHINIST.

OHIO

Wanted—Draftsman with experience on electric traveling cranes; steady employment and good wages to competent man. Address Toledo Bridge & Crane Co., Toledo, O.

Wanted—Foreman or superintendent for well established, growing machine tool manufacturing company; replies will be treated strictly confidential. Box 801, AMER. MACH.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Wanted at once, several good molders on heavy work, also several machinists; give full details, past employment, length of engagements, kind of work and wages expected. Box 818, AMERICAN MACHINIST.

Machine designer wanted in Reading, Penn., with experience on machine tools; one who has had machine shop practice. Address, stating full experience, age, references, etc. Box 807, AMERICAN MACHINIST.

Wanted—One foreman mechanic at $1500 per annum; a competitive examination will be held May 12, 1911, for the purpose of filling the above position. For further information address "Governor," U. S. Naval Home, Philadelphia, Penn.

Two first-class outside erecting engineers wanted; intelligent and active men qualified to superintend the assembling of engines, condensers, pumps, etc., and to test out same after erection; must thoroughly understand drawings; give full particulars as to experience, age and salary wanted. Box 797, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Fifty tool designers; experienced competent men in the design of jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

WISCONSIN

Wanted—Chief draftsman; applicant must have good experience in all branches of designing for shop manufacturing heavy sawmill machinery. Box 795, AMER. MACH.

Wanted—By a firm manufacturing saw mill machinery, an experienced toolmaker with common sense ideas and good habits; married man about 35 years of age preferred. Box 783, AMERICAN MACHINIST.

Wanted at Once—Expert tool designer and machine shop foreman; thorough mechanic having experience with good machine shop practice and production; state actual experience, age, references and salary expected. Box 764, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

First class all-around machinist and shop engineer wants position; twenty years' experience designing and building special and experimental machinery; moderate salary to start; would acquire interest if desired. Address "Mechanic," AMERICAN MACHINIST.

ILLINOIS

I am looking for advancement beyond the possibilities afforded by my present employer; assistant to district sales manager of electric machinery manufactory; experienced in selling, clerical, practical and theoretical ends; at present earning $1000 per year and commissions; can take full charge of branch office, local representative or factory; can leave Chicago. Box 808, AMER. MACHINIST.

MASSACHUSETTS

Forging and tempering foreman, ten years in present place, change desired about July 1. Box 806, AMERICAN MACHINIST.

Mechanical inspector, holding responsible position with large concern, wishes to change location. Box 777, AMERICAN MACHINIST.

Machine designer, five years' shop and 10 years' drafting experience on automatic, special and shoe machinery. F. W. Meyer, Gen. Del'y, Northampton, Mass.

Superintendent, fine interchangeable work, broad mechanical experience, successful in handling help, good references, satisfactory reasons for desiring change; salary $3000. Box 793, AMERICAN MACHINIST.

Mechanical superintendent accustomed to medium and small interchangeable work requiring accuracy, thoroughly competent, good executive, sober, reliable, desires change. Box 799, AMERICAN MACHINIST.

Mechanical engineer with 20 years' experience wants position as chief draftsman or machine designer; 12 years' experience as chief draftsman on special machinery, printing presses and paper-handling machinery; best of references. Box 798, AMER. MACH.

Young mechanical man, technically trained with 14 years' practical experience, held positions as erecting engineer, chief inspector and master mechanic in Europe and the United States in steam engine and automobile line, having a responsible position now, but desire change; best references. Box 790, AMERICAN MACHINIST.

MICHIGAN

Mechanical engineer, experienced on gas engines, gas producers and other machines, is open for engagement; competent to organize engineering department; thorough, accurate, reliable. Address "Engineer," AM. MA.

NEW JERSEY

Mechanical draftsman desires position; technical graduate; 10 years' varied experience. Box 792, AMERICAN MACHINIST.

Am wanting to be placed with responsibility in the valve and fittings line; have qualified in the various departments between foundry and shipping room, particularly the tool, and can produce the papers to show for it. Box 776, AMERICAN MACHINIST.

NEW YORK

Foreman patternmaker wishes a position; 10 years foreman, three years in foundry, four years automobile. Box 815, AMERICAN MACHINIST.

Foreman—Uptodate on tools, jigs and general manufacture; first-class executive, desires change, excellent references. Box 814, AMERICAN MACHINIST.

A-1 tool and die maker, 10 years' experience, desires responsible position, or, one where advancement is assured; employed at present. Box 805, AMERICAN MACHINIST.

Mechanical expert, 16 years' experience in shop and drafting room on fine intricate machinery, familiar with uptodate methods, wishes position as superintendent or head draftsman. Box 816, AMER. MACH.

Young man, 30, eight years' experience in machine shop and familiar with machine tools, and five years' experience in iron and steel, wishes position with reliable house as salesman. Box 794, AMERICAN MACHINIST.

Manager or superintendent, capable of taking entire charge of a manufacturing plant, desires to make a change; experience with and references from three of the largest, best known plants in America. Box 754, AMERICAN MACHINIST.

Graduate mechanical engineer, nine years' general experience, five years with air compressor builders, design, testing, development of electric driven units, special problems in air and natural gas compression, sales engineering and publicity work, wants responsible position with compressor builders; at present employed. Box 770, AMER. MACH.

OHIO

Technical graduate, eight years' shop, engineering and executive experience. Box 786, AMERICAN MACHINIST.

PENNSYLVANIA

I wish to correspond with a firm desiring the services of an uptodate mechanic to act as foreman; seven years a shop foreman; wants a change. Box 809, AMER. MACH.

General foreman, designer, expert on tools and dies, desires change; good technical education; 12 years of experience in adding machine, typewriter, gun and electric work; modern executive; a German who has been through the mill and can guarantee results. Box 804, AMERICAN MACHINIST.

Superintendent or assistant superintendent; age 39; have had 25 years' shop experience, 20 years' designing tools and special machinery, last ten years in charge of drawing rooms of from 10 to 35 draftsmen; good on system and a producer; original in designing and fully posted on uptodate manufacturing methods along typewriter, adding machine and gun lines. Box 800, AMER. MACH.

FOR SALE

Old established plant manufacturing high grade line of equipment, for sale; in operation thirty-seven years; now running; price right. Wm. H. H., 1818 Holland St., Erie, Penn.

For Sale—One vertical two-cylinder Westinghouse 25-horsepower stationary gas engine; complete with self-starting apparatus; in first-class condition. L. M. Co., Care AMERICAN MACHINIST.

Factory for sale in New England, suitable any business; 60,000 feet floor space; railroad siding; 650 horsepower of water, same steam power; great bargain. Nicholson & Co., factory brokers, 150 Broadway, New York.

For Sale—One story and basement brick machine shop, forty by one hundred feet, fully equipped for light work, now running, located in growing town within fifty miles of Philadelphia, on two trunk lines; or will combine with party having good light mechanical line; references exchanged; no agents or triflers. Box 747, AMERICAN MACHINIST.

For Sale—A modern constructed machine shop and foundry, located in the Central West's manufacturing district; unsurpassed railroad facilities; 75,000 square feet floor space, modern equipment, foundry fully equipped for light and medium heavy work and has an established trade; will consider consolidation with any established business that requires a foundry and machine shop for the manufacture of its product. Box 810, AMERICAN MACHINIST.

For Sale—One second-hand 8½x16" Potter & Johnston automatic chucking and turning machine, in use for just four years, and having had the best care is in very good condition; has standard 3 9/16" spindle, triple geared automatic change speed head, heavy cross slide, oil pump and oil pan base; the machine is fitted with a special drawback bar and hand lever for operating expanding collet arbors through the spindle, somewhat similar to the backfacing attachment; the backfacing attachment sometimes supplied with these machines, could quite easily be fitted to it; weight, 8000 pounds. Box 766, AM. MA.

Talks With Our Readers

By The Sales Manager

A New England manufacturer recently said to an advertising man: "I believe that my new machine is one of the best on earth for its purpose. It is the result of years of thought and work. But it has just one defect,—a slight one comparatively, but enough to make it a poor advertising proposition.

"I could sell many of them through your paper, but they wouldn't stay sold. That little defect would develop shortly and my money and effort would have been wasted.

"I couldn't get a single repeat order nor an order through the recommendation of a user; and you know as well as I do that my advertising would prove a failure unless my goods made good.

"When I have remedied that defect, you can gamble I'll be with you.

"But I can't afford to put our trademark on this machine and advertise it, because it has not yet reached the *standard* which our trademark represents."

There's an illuminating point in those remarks for every buyer of machinery and equipment.

When a manufacturer adopts and advertises a trademark he guards it jealously. For him it possesses a living, breathing personality—an individuality. It is *himself*—his aims, his objects, his ideals.

He knows that, properly advertised and lived up to, that trademark becomes the most valuable asset in his business. He knows that, once well known and established, the "good-will" represented by that trademark will bring a greater price than his factory, his equipment, his office furniture, the office cat and the office boy combined.

If you doubt that, try to buy the right to do business as jewelers and silversmiths under the name of Tiffany & Co.

Their enormous stock of precious stones, their objects of silver and gold are not worth one part of the value of the simple firm name.

When a manufacturer trademarks a machine he sets upon it the seal of his belief in it.

Then he spends thousands to advertise it with the belief that the *repeat orders* will pay him for his advertising investment.

He knows the machine from A to Izzard—how it will work under all manner of conditions.

This development work is costly to him, but he knows it is necessary.

So he tries it out, works over it, experiments in all directions until he knows it is right. Then he advertises.

Under these circumstances is it to be wondered at that goods continuously advertised are *reliable?*

Or can there be any doubt that it *pays* to read advertisements and buy advertised goods?

* * *

A trademark is not necessarily a picture nor a "slogan," nor does it necessarily, in the sense we refer to it, have to bear the word "Trademark."

It may be just the name of the firm.

Honest firms are not putting their name onto dishonest goods.

And dishonest firms are not doing much advertising.

They can't in the AMERICAN MACHINIST.

Putting faith in advertised products is your measure of protection when you go into the market to buy.